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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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02 Aircraft **2612**
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems **2617**
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology **2622**
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

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Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

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Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics **2646**
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

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Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

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13 Geophysics **2656**
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography **2671**
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes **2676**
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Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic **2682**
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 2688
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

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Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2692
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2697
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

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Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

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Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

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29 Space Radiation 2711
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 2713
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 2719
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

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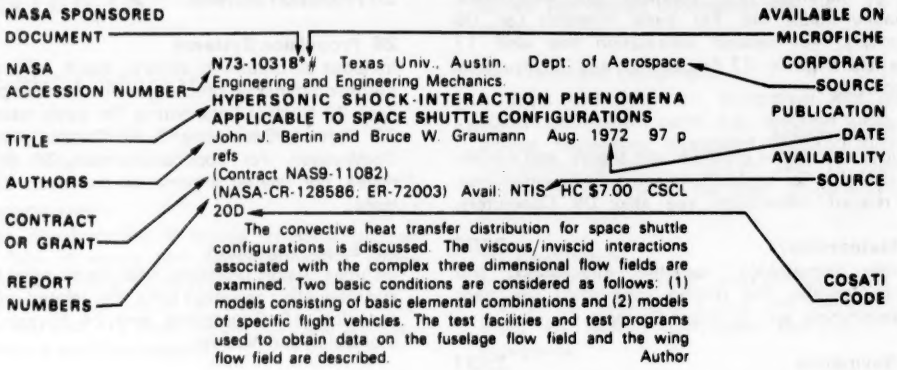
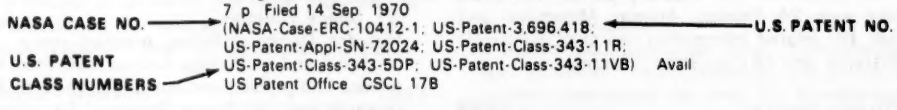


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

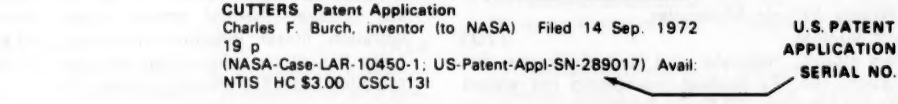
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



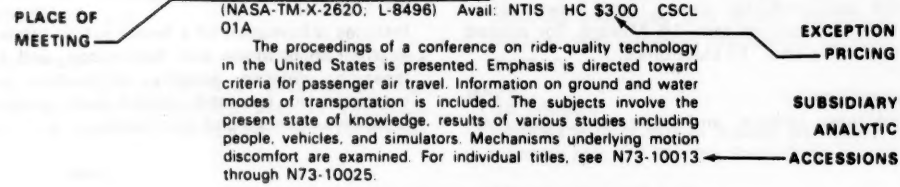
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02) CSCL 01A

VOLUME 11 NUMBER 22 / NOVEMBER 23, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-30926*# Wisconsin Univ., Milwaukee.
FINITE ELEMENT ANALYSIS AND COMPUTER GRAPHICS VISUALIZATION OF FLOW AROUND PITCHING AND PLUNGING AIRFOILS
Theodore Bratanow and Akin Ecer Washington NASA Sep. 1973 72 p refs
(Grant NGR-50-007-001)
(NASA-CR-2249) Avail: NTIS HC $3.50 CSCL 01A

A general computational method for analyzing unsteady flow around pitching and plunging airfoils was developed. The finite element method was applied in developing an efficient numerical procedure for the solution of equations describing the flow around airfoils. The numerical results were employed in conjunction with computer graphics techniques to produce visualization of the flow. The investigation involved mathematical model studies of flow in two phases: (1) analysis of a potential flow formulation and (2) analysis of an incompressible, unsteady, viscous flow from Navier-Stokes equations. Author

N73-30927*# Creare, Inc., Hanover, N.H.
PRESSURE RECOVERY PERFORMANCE OF CONICAL DIFFUSERS AT HIGH SUBSONIC MACH NUMBERS
Francis X. Dolan and Peter W. Runstadler, Jr. Washington NASA Jul. 1973 146 p refs
(Contract NAS3-15331)
(NASA-CR-2299; TN-165) Avail: NTIS HC $4.50 CSCL 01A

The pressure recovery performance of conical diffusers has been measured for a wide range of geometries and inlet flow conditions. The approximate level and location (in terms of diffuser geometry of optimum performance were determined. Throat Mach numbers from low subsonic (m sub t equals 0.2) through choking (m sub t equals 1.0) were investigated in combination with throat blockage from 0.03 to 0.12. For fixed Mach number, performance was measured over a fourfold range of inlet Reynolds number Maps of pressure recovery are presented as a function of diffuser geometry for fixed sets of inlet conditions. The influence of inlet blockage, throat Mach number, and inlet Reynolds number is discussed. Author

N73-30928*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF THE FLOW AROUND SHARP-EDGED SLENDER DELTA WINGS WITH LARGE ANGLES OF ATTACK
D. Hummel Washington NASA Sep. 1973 29 p refs Transl. into ENGLISH from Z. Flugwiss. (W. Germany), v. 15, Oct. 1967 p 376-385 Presented at the 10th Meeting for the Aerodynamic Group of the WGLR, Munich, 8 Dec. 1966
(Contract NASw-2483)
(NASA-TT-F-15107) Avail: NTIS HC $3.50 CSCL 01A

Evaluation of measurements carried out on a sharp-edged slender delta wing of an aspect ratio of 1 at an angle of attack of 20.5 degrees and a Reynolds number RE = 900,000. The bound vortex lines in the lifting surface were determined from the measured velocities of the outer edge of the boundary layer on the upper and lower side of the wing. In the region of maximum lift, the vortex breakdown was prevented by means of suction within the vortices. Measurements of forces and pressure distributions show a considerable increase of lift due to suction within the vortices. The reasons for the decrease of lift on sharp-edged slender wings at large angles of attack are discussed. Author

N73-30929*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF AN AIRFOIL OPTIMIZED FOR MAXIMUM LIFT COEFFICIENT
Gene J. Bingham (Army Air Mobility R and D Lab., Ft. Eustis, Va.) and Allen When-shin Chen Washington Dec. 1972 54 p refs
(NASA-TN-D-7071; L-8491) Avail: NTIS HC $3.50 CSCL 01A

An investigation has been conducted in the Langley low-turbulence pressure tunnel to determine the two-dimensional characteristics of an airfoil optimized for maximum lift coefficient. The design maximum lift coefficient was 2.1 at a Reynolds number of 9.7 million. The airfoil with a smooth surface and with surface roughness was tested at angles of attack from 6 deg to 26 deg, Reynolds numbers (based on airfoil chord) from 2.0 million to 12.9 million, and Mach numbers from 0.10 to 0.35. The experimental results are compared with values predicted by theory. The experimental pressure distributions observed at angles of attack up to at least 12 deg were similar to the theoretical values except for a slight increase in the experimental upper-surface pressure coefficients forward of 26 percent chord and a more severe gradient just behind the minimum-pressure-coefficient location. The maximum lift coefficients were measured with the model surface smooth and, depending on test conditions, varied from 1.5 to 1.6 whereas the design value was 2.1. Author

N73-30930*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
A STUDY OF TRAILING EDGE BLOWING AS A MEANS OF REDUCING NOISE GENERATED BY THE INTERACTION OF FLOW WITH A SURFACE
Terry D. Scharton, Benjamin Pinkel, and John F. Wilby 28 Sep. 1973 54 p refs
(Contract NAS1-9559)
(NASA-CR-132270; BBN-2593) Avail: NTIS HC $4.75 CSCL 01A

A system for reducing the noise generated when a jet impinges against a flap is described. The eddies formed by the alternate zones of positive and negative pressure on the flap surface are identified as the sound source. In the proposed concept, a stream of low velocity secondary air is ejected from a slot near the trailing edge of the flap as a buffer between the flap and the primary air jet to reduce the intensity of the fluctuating surface

pressure field near the flap edge and thus reduce the intensity of the aerodynamic noise. Author

N73-30931# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

AERODYNAMIC COMPARISON OF TWO REAR FUSELAGE SHAPES (PENCIL-POINT AND KNIFE-EDGE) [AERODYNAMISCHER VERGLEICH ZWEIER RUMPFHECKFORMEN (SPINDELHECK UND TUBENHECK)]

Gerhard Schulz and Karl Wichmann 30 Mar. 1972 65 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-25) Avail: NTIS HC $5.25; DFVLR, Porz, West Ger. 23,10 DM

In order to optimise the aerodynamic shape of the rear part of aircraft fuselages, two models with the same shape rotational front part but with different rear parts were developed. The first rear part was an axisymmetric body, while the second ran out into a knife-edge. The influence of the knife-edge rear part (also called 'tube rear part') on the aerodynamic forces and moments were investigated using lateral force and pressure distribution measurements. ESRO

N73-30932# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE CALCULATED GROWTH OF LIFT AND MOMENT ON A SWEPT WING ENTERING A DISCRETE VERTICAL GUST AT SUBSONIC SPEEDS

H. C. Garner London Aeron. Res. Council 1973 58 p refs Supersedes RAE-TR-72010; ARC-33854

(ARC-CP-1241; RAE-TR-72010; ARC-33854) Avail: NTIS HC $5.00; HMSO 95p; PHI $3.90

Unsteady aerodynamic forces on a wing due to a uniform step gust are expressed as a sine transform of those due to sinusoidal gusts over the spectrum of wavelength. The sinusoidal gusts are treated by subsonic lifting-surface theory until the wavelength becomes so small as to demand excessive terms in the chordwise loading. Beyond this, the substitution of piston theory is discussed for a wing representative of design for subsonic cruise. Lift and pitching moment are calculated for normal entry into a step gust at Mach numbers 0.4 and 0.8, with reasonable success in the latter case. The results for small distances of penetration are examined critically. It is recommended that the proportional growth of aerodynamic force be taken between the results of piston theory and the present method of small distances before approaching the latter result, which leads to the correct asymptotic behavior soon after the wing is completely immersed in the gust. The investigation ends with some calculations by the present method of normal entry into a ramp gust and by piston theory for oblique entry into a step gust. Author (ESRO)

N73-30933# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

MEASUREMENT OF THE INTERNAL PERFORMANCE OF A RECTANGULAR AIR INTAKE HAVING VARIABLE GEOMETRY COMPRESSION SURFACES AT MACH NUMBERS FROM 1.7 TO 2.5 PART 2: THE EFFECT OF INCIDENCE

C. S. Brown and E. L. Goldsmith London ARC 1973 67 p refs

(ARC-CP-1242) Avail: NTIS HC $5.50; HMSO £1.20; PHI $4.90

Measurements were made of the internal performance of a rectangular intake having variable geometry compression surfaces. The measurements were made within a range of Mach numbers from 1.7 to 2.46 at angles of incidence up to 10 degrees. The Reynolds number based on intake height was about 1.5 times one million for Mach numbers above 2 and 0.6 times one million for Mach numbers below 2. It was determined that shock patterns can be used to predict accurately maximum mass flow and shock pressure recovery provided the assumption is made that the initial wedge angle is increased by just under one degree. It is also shown that simple assumptions can be made as to the form of the shock pattern in order to extend these predictions into regions of shock detachment which arise inevitably when the intake is at large angles of incidence. Author (ESRO)

N73-30934# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

MEASUREMENT OF THE INTERNAL PERFORMANCE OF A RECTANGULAR AIR INTAKE WITH VARIABLE GEOMETRY AT MACH NUMBERS FROM 1.7 TO 2.5, PART 1

C. S. Brown and E. L. Goldsmith London Aeron. Res. Council 1973 71 p refs Supersedes RAE-TR-71159; ARC-33681

(ARC-CP-1243-Pt-1; RAE-TR-71159; ARC-33681) Avail: NTIS HC $5.75; HMSO £1.10; PHI $4.30

Measurements were made of the internal performance of a rectangular intake having variable geometry compression surfaces. The measurements have been made over a range of Mach numbers from 1.70 to 2.46. The Reynolds number based on intake height was between 1.27 and 1.54 million. Pressure recoveries at zero bleed are well below those predicted from simple shock patterns, but there is a substantial gain with increase of bleed flow particularly at Mach numbers above 2. Subcritical stable flow range correlated quite well with the Ferri instability criterion. Author (ESRO)

N73-30935# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE LIFT AND STALLING CHARACTERISTICS OF A 35 deg SWEPT BACK WING DESIGNED TO HAVE IDENTICAL CHORDWISE PRESSURE DISTRIBUTIONS AT ALL SPANWISE STATIONS WHEN NEAR MAXIMUM LIFT

D. S. Woodward and D. E. Lean London Aeron. Res. Council 1973 135 p refs Supersedes RAE-TR-71050; ARC-33417

(ARC-R/M-3721; RAE-TR-71050; ARC-33417) Avail: NTIS HC $8.75; HMSO £4.80; PHI $18.65

A 35 degree swept back wing with aspect ratio of 7 has been designed so that the planform gives a constant spanwise coefficient of lift distribution, while the camber and twist distributions, coupled with local thickness modifications, combine to provide identical chordwise pressure distributions at all spanwise stations at an overall coefficient of lift of 0.8. At mid-semi span the airfoil section normal to the mean sweep line was 12.2 percent thick and the design coefficient of lift was chosen to be close to the maximum value obtained experimentally for this section. Overall forces, flow visualization, and pressure plotting tests were conducted at three Reynolds numbers. Author (ESRO)

N73-30936# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

ON VISCOUS AND WIND-TUNNEL WALL EFFECTS IN TRANSONIC FLOWS OVER AIRFOILS

Robert E. Melnik and David C. Ives Jul. 1973 21 p refs Presented at the 6th AIAA Fluid and Plasma Dyn. Conf., Palm Springs, Calif., 16-18 Jul. 1973

(AD-764133; RE-459J) Avail: NTIS CSCL 01/3

An extensive correlation between wind-tunnel data and finite-difference solutions of the exact potential-flow equation was performed. Two procedures are compared, one using the Kutta condition and the other using the experimental lift coefficient to determine the circulation. The numerical calculations are used to extract viscous and wall interference effects from the data. The correlation results indicate that viscous effects on lift are greater than 30%, even for turbulent boundary layers and Reynolds numbers greater than 2 x 10 to the seventh power. It is shown that viscous effects can be almost completely accounted for in numerical calculations by adjusting the circulation to match the experimental lift. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-30937 Tennessee Univ., Knoxville.
TURBULENCE AND AERODYNAMIC NOISE CHARACTERISTICS OF JET FLAP TYPE EXHAUST FLOWS Ph.D. Thesis
Guenter Otto Herbert Schrecker 1972 163 p
Avail: Univ. Microfilms Order No. 73-12436

An experimental investigation of the aerodynamic noise and flow field characteristics of internal-flow jet-augmented flap configurations is presented. A parametric study of the influence of the Mach number (subsonic range only), the slot nozzle aspect ratio and the flap length on the overall radiated sound power and the spectral composition of the jet noise as measured in a reverberation chamber was conducted. Mean and fluctuating velocity profiles, spectra of the fluctuating velocity and space correlograms were measured in the flow field of jet flaps by means of hot-wire anemometry. An attempt was made to estimate the overall sound power radiated by the free mixing region that originates at the orifice of the slot nozzle (primary mixing region) relative to the overall sound power generated by the free mixing region that originates at the trailing edge of the flap (secondary mixing region). Dissert. Abstr.

N73-30938*# Aeronautical Research Associates of Princeton, Inc., N.J.
INTEGRATED LIFT/DRAG CONTROLLER FOR AIRCRAFT Patent Application
John W. Olcott, Edward Seckel, and David R. Ellis, inventors (to NASA) Filed 23 Mar. 1972 25 p
(Contract NAS2-5589)
(NASA-Case-ARC-10456-1; US-Patent-Appl-SN-237491) Avail: NTIS HC $3.25 CSCL 01C

An integrated lift/drag controller for aircraft is described. The system integrates the control of engine power and devices which are capable of altering the lift/drag ratio of a powered aircraft. Specific application is to control the glide path angle and air speed of the aircraft during approach, flare, touchdown, rollout, and emergency descents. Diagrams of the system and details of the operation are presented. P.N.F.

N73-30939*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A FUSELAGE MODEL WITH VARIOUS ARRANGEMENTS OF ELONGATED LIFT JETS
Raymond D. Vogler and Kenneth W. Goodson Washington Aug. 1973 86 p refs
(NASA-TN-D-7299; L-8753) Avail: NTIS HC $3.75 CSCL 01A

Data were obtained for a round jet located on the center of the bottom of a fuselage and for elongated slots separated spanwise by distances of 0.8 and 1.2 of the fuselage width. The effect of yawing the slots, inclining the jets laterally, and combining slot yaw with jet inclination was determined. Data were obtained in and out of ground effect through a range of effective velocity ratios and through a range of sideslip angles. Author

N73-30940*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
COMPARISONS OF PREDICTIONS OF THE XB-70-1 LONGITUDINAL STABILITY AND CONTROL DERIVATIVES WITH FLIGHT RESULTS FOR SIX FLIGHT CONDITIONS
Chester H. Wolowicz and Roxanah B. Yancey Washington Aug. 1973 44 p refs
(NASA-TM-X-2881; H-773) Avail: NTIS HC $3.00 CSCL 01C

Preliminary correlations of flight-determined and predicted stability and control characteristics of the XB-70-1 reported in NASA TN D-4578 were subject to uncertainties in several areas which necessitated a review of prediction techniques particularly for the longitudinal characteristics. Reevaluation and updating of the original predictions, including aeroelastic corrections, for six specific flight-test conditions resulted in improved correlations of static pitch stability with flight data. The original predictions for the pitch-damping derivative, on the other hand, showed better correlation with flight data than the updated predictions. It appears that additional study is required in the application of aeroelastic corrections to rigid model wind-tunnel data and the theoretical determination of dynamic derivatives for this class of aircraft. Author

N73-30941*# Columbia Univ., New York. Noise Research Unit.
ANNOYANCE JUDGEMENTS OF AIRCRAFT WITH AND WITHOUT ACOUSTICALLY TREATED NACELLES
Paul N. Borsky and Skipton Leonard Washington NASA Aug. 1973 73 p
(Grant NGL-33-008-118)
(NASA-CR-2261) Avail: NTIS HC $3.00 CSCL 01C

A series of subjective response laboratory tests were conducted to determine the effectiveness of reducing aircraft noise by treating the aircraft engine nacelles with acoustically absorbent material. A total of 108 subjects participated in the magnitude estimation tests. The subjects were selected from persons who had previously been interviewed and classified according to selected psychological characteristics. The subjects lived in three general areas located at three specified distances from New York's Kennedy Airport. The aircraft signals used in the tests consisted of tape recordings of the landing approach noise of a B-727 aircraft under normal operating conditions. These recordings were electronically altered to simulate an aircraft with acoustically treated nacelles to achieve noise reductions of approximately 6 EPNdB and 12 EPNdB. The results from these tests indicate that significant reductions in annoyance resulted from the synthesized nacelle treatments. Author

N73-30942# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
DIRECTIONAL EQUIPMENT FOR REDUCING JET NOISE AT HIGH SPEED [DISPOSITIES DIRECTIONNELS DE REDUCTION DU BRUIT DES JETS A GRANDE VITESSE]
R.-G. Hoch, M. Julliand, and H. Lacombe [1972] 32 p refs In FRENCH Presented at 1st Intern. Symp. on the Progr. of Aviation Reactors, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $3.75

A study was made of methods used to reduce the noise ejected by Concorde propellers at different speeds. The equipment developed to suppress the noise along with aerodynamic parameters and geometrics is described. Transl. by E.H.W.

N73-30943*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTERIZED PRELIMINARY DESIGN AT THE EARLY STAGES OF VEHICLE DEFINITION
Thomas J. Gregory Sep. 1973 35 p refs
(NASA-TM-X-62303) Avail: NTIS HC $3.75 CSCL 01C

Criteria for acceptance of early design information, modern methods of providing it, and suggestions for defining adequate levels of resources to accomplish the objectives of the activity are described. Specific examples of the most difficult type of early design studies, those requiring significant undeveloped technology, are used to discuss these points. The examples include design studies and cost estimates of liquid hydrogen fueled aircraft, oblique winged aircraft and remotely piloted vehicles. Author

N73-30944*# National Research Council of Canada, Ottawa (Ontario). Unsteady Aerodynamics Lab.
SUPERSONIC EXPERIMENTS ON DYNAMIC CROSS-DERIVATIVES DUE TO PITCHING AND YAWING OF AIRCRAFT-LIKE VEHICLES
K. J. Orlik-Ruckemann, J. G. LaBerge, and E. S. Hanff Aug. 1973 45 p refs
(Contract NASw-2369)
(NASA-CR-114663; LTR-UA-24) Avail: NTIS HC $4.25 CSCL 01C

A wind tunnel apparatus has been developed and constructed for the determination of moment cross-derivatives due to pitching and yawing on models at moderate angles of attack and sideslip. The apparatus can also be used to determine the direct moment derivatives in pitch and yaw. Experimental results were obtained at Mach 2 on a cone-wing-fin configuration at angles of attack and sideslip up to 15. Although at small values of these angles the cross-derivatives were always negligibly small, measureable effects were sometimes observed, at all angles of

attack included in this investigation (i.e. up to 15 deg), when the angle of sideslip was 10 deg or 15 deg. Author

N73-30945# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: NORTH CENTRAL AIRLINES, INCORPORATED, MCDONNEL DOUGLAS DC-9-31, N954N AND DELTA AIR LINES, INCORPORATED, CONVAIR CV-880, N8807E, O'HARE INTERNATIONAL AIRPORT, CHICAGO, ILLINOIS, 20 DECEMBER 1972
5 Jul. 1973 45 p
(NTSB-AAR-73-15) Avail: NTIS HC $4.25

An aircraft accident involving the collision of a DC-9 and a CV-880 at the intersection of a runway and a taxiway at O'Hare International Airport, Chicago, Illinois on 20 December 1972 is reported. The probable cause of the accident was failure of the traffic control system to insure separation of the aircraft during a period of restricted visibility. Incomplete and ambiguous instructions from the traffic controller are cited as well as failure of the CV-880 flight crew to request clarification of communication. Author

N73-30946# Mitre Corp., McLean, Va.
CIVIL AVIATION MIDAIR COLLISIONS ANALYSIS, JANUARY 1964 - DECEMBER 1971
T. R. Simpson, R. A. Rucker, and J. P. Murray Washington FAA May 1973 174 p refs
(Contract DOT-FA70WA-2448)
(MTR-6334; FAA-EM-73-8) Avail: NTIS HC $10.75

A statistical analysis of civil aviation midair collisions occurring during the period January 1964 to December 1971 is presented. The effectiveness of the air traffic control system in preventing midair collisions is assessed. Problem areas for which solutions are required are identified. The analysis shows that no midair collisions occurred when both aircraft were identified and under radar/beacon surveillance, under positive control, and both pilots conformed to their air traffic control clearances. Author

N73-30947# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: UNITED AIR LINES, INCORPORATED BOEING 737, N9031U CHICAGO-MIDWAY AIRPORT, CHICAGO, ILLINOIS, 8 DECEMBER 1972
8 Dec. 1972 65 p refs
(NTSB-AAR-73-16; SA-435) Avail: NTIS

The crash of a Boeing 737 aircraft during an instrument approach to Chicago-Midway airport, Illinois on 8 December 1972 is reported. The aircraft crashed in a residential area approximately 1.5 miles from the runway approach. The probable cause of the accident was the pilot's failure to exercise positive flight management during the approach, which culminated in a critical deterioration of airspeed into the stall regime. Author

N73-30948*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft.
APPLICATION OF COMPOSITES TO HELICOPTER AIRFRAME AND LANDING GEAR STRUCTURES Technical Report, Jul. 1972 - Feb. 1973
M. J. Rich, G. F. Ridgley, and D. W. Lowry Jun. 1973 138 p refs Sponsored in part by Army Air Mobility R and D Lab., Hampton, Va.
(Contract NAS1-11688)
(NASA-CR-112333) Avail: NTIS HC $9.00 CSCL 01C

A preliminary design study has indicated that advanced composite helicopter airframe structures can provide significant system cost advantages in the 1980's. A seven percent increase in productivity and a five percent reduction in life cycle cost are projected. Due to their complexity, landing gear structures do not substantially benefit from the use of advanced composites. The most successful concept was found to be all-molded composite modular panels, which provide integral skin/stringer and frame subassemblies. These subassemblies significantly reduce the number of parts relative to present construction. The subassemblies are mechanically jointed together for economical, rapid final assembly and permit field replacement in the event of major damage. Author

N73-30949*# Bell Helicopter Co., Fort Worth, Tex.
V/STOL TILT ROTOR STUDY. VOLUME 5: A MATHEMATICAL MODEL FOR REAL TIME FLIGHT SIMULATION OF THE BELL MODEL 301 TILT ROTOR RESEARCH AIRCRAFT
P. B. Harendra, M. J. Joglekar, T. M. Gaffey, and R. L. Marr 13 Apr. 1973 265 p refs
(Contract NAS2-6599)
(NASA-CR-114614; Bell-301-099-001-Vol-5) Avail: NTIS HC $15.25 CSCL 01C

A mathematical model for real-time flight simulation of a tilt rotor research aircraft was developed. The mathematical model was used to support the aircraft design, pilot training, and proof-of-concept aspects of the development program. The structure of the mathematical model is indicated by a block diagram. The mathematical model differs from that for a conventional fixed wing aircraft principally in the added requirement to represent the dynamics and aerodynamics of the rotors, the interaction of the rotor wake with the airframe, and the rotor control and drive systems. The constraints imposed on the mathematical model are defined. Author

N73-30950*# Bell Helicopter Co., Fort Worth, Tex.
V/STOL TILT ROTOR STUDY. VOLUME 6: HOVER, LOW SPEED AND CONVERSION TESTS OF A TILT ROTOR AEROELASTIC MODEL (MODEL 300)
R. L. Marr, K. W. Sambell, and G. T. Neal 15 May 1973 326 p refs
(Contract NAS2-6599)
(NASA-CR-114615; Bell-301-099-002-Vol-6) Avail: NTIS HC $18.50 CSCL 01C

Stability and control tests of a scale model of a tilt rotor research aircraft were conducted. The characteristics of the model for hover, low speed, and conversion flight were analyzed. Hover tests were conducted in a rotor whirl cage. Helicopter and conversion tests were conducted in a low speed wind tunnel. Data obtained from the tests are presented as tables and graphs. Diagrams and illustrations of the test equipment are provided. Author

N73-30951*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF REYNOLDS NUMBER AND ENGINE NACELLES ON THE STALLING CHARACTERISTICS OF A MODEL OF A TWIN-ENGINE LIGHT AIRPLANE
Vernard E. Lockwood Washington Dec. 1972 36 p refs
(NASA-TN-D-7109; L-8591) Avail: NTIS HC $3.00 CSCL 01C

The investigation was made on a 1/18-scale model of a twin-engine light airplane. Static longitudinal, lateral, and directional characteristics were obtained at 0 deg and plus or minus 5 deg sideslip at a Mach number of about 0.2. The angle of attack varied from about 20 deg at a Reynolds number of 0.39 times one million to 13 deg at a Reynolds number of 3.7 times one million, based on the reference chord. The effect of fixed transition, vertical and horizontal tails, and nacelle fillets was studied. Author

N73-30952*# Rao (G. V. R.) and Associates, Sherman Oaks, Calif. Aerodynamics and Propulsion Technology.
ANALYTICAL LIFT FAN NOISE STUDY Interim Report, 13 Apr. 1971 - 13 June 1972
G. V. R. Rao, Wing T. Chu, and R. V. Digumarthi 13 Jul. 1973 78 p refs
(Contract NAS2-6401)
(NASA-CR-114576) Avail: NTIS HC $6.00 CSCL 01C

Based on reasonable estimates of flow conditions occurring in an axial fan, acoustic radiation from various noise sources is evaluated. Results of computations on two specific fans are presented, and relative significance of the various sources is examined. Author

N73-30953# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Flugbahnen.
DESIGN OF A LATERAL FLIGHT DIRECTOR
Wolfram Schattenmann 13 Jul. 1972 42 p refs In GERMAN; ENGLISH summary

DLR-FB-72-44) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. 12,80 DM

In designing a Flight Direct (FD), two aspects have to be considered: effective director-vehicle-system performance and good pilot rating. Recently the knowledge about the human controller has reached a level where the analytical design of a manual control system is possible. With regard to the FD design principles for a FD were developed and applied to a longitudinal FD in landing approach. In the present paper, a lateral FD is designed for the same requirements. The state variables for computing the FD-signal are specified and their influence on the system FD-pilot-vehicle is analytically estimated.

Author (ESRO)

N73-30954# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

AIRCRAFT FLUTTER SIMULATION BY MEANS OF THE ELECTRONIC ANALOG COMPUTER WITH SPECIAL REGARD TO STRUCTURAL NONLINEARITIES Ph.D. Thesis - Tech. Univ. Brunswick

E. Breitbach 24 Jan. 1973 129 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-30; AVA-FB-7228) Avail: NTIS HC $8.50; DFVLR, Porz, West Ger. 39 DM

The fundamental theoretical relations for aircraft flutter simulation by means of an electronic analog computer and a general description of an appropriate computer mechanization are presented. Processing from Lagrange's equations, the governing aeroelastic stability equations are given in terms of natural mode functions. With regard to a real time flutter simulation, the unsteady aerodynamic forces are determined by application of the two-dimensional incompressible strip theory including Wagner's function for arbitrary non-uniform motions. The practical application of the developed method is demonstrated for a wing-aileron system and some typical results are presented and discussed. As a special advantage of the analog simulation, the influence of a nonlinear spring in the aileron hinge on the flutter stability is investigated for numerous variations of spring characteristics. Author (ESRO)

N73-30955# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

COMPARATIVE TURBULENCE FOR A CANBERRA AND A VULCAN FLYING TOGETHER AT LOW ALTITUDE

J. K. Curran London Aeron. Res. Council 1973 26 p refs Supersedes RAE-TR-71100; ARC-33862

(ARC-CP-1244; RAE-TR-71100; ARC-33862) Avail: NTIS HC $3.50; HMSO 45p; PHI $1.95

Measurements were made of the response of turbulence of two aircraft, a Vulcan and a Canberra, while flying together over land and over the sea. Gust velocities derived from the normal acceleration of the two aircraft were compared and reference made to the spectral densities of the normal accelerations to account for differences in the results. Additional information on aircraft response was obtained from the spectra of wing strain measured near the wing root. Author (ESRO)

N73-30956# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

POSTBUCKLING BEHAVIOR OF A SECTION OF THE B-1 AFT INTERMEDIATE FUSELAGE Technical Report, Jul. - Dec. 1972

J. Skogh and P. Stern May 1973 51 p refs

(Contract F33615-69-C-1523; AF Proj. 1467)

(AD-763813; AFFDL-TR-73-63) Avail: NTIS CSCL 01/3

A section of the B-1 aft intermediate fuselage consisting of a combination of flat and curved panels was analyzed for postbuckling strength under a combination of torque and axial loading. The analysis, which extended to load levels about ten times the load that produces the first buckle, was carried out rigorously by the use of the finite-difference computer code STAGS. The results show that the fuselage section does not collapse at the applied load were calculated. These data can be used as inputs for a finite-element analysis of the fuselage section. Author (GRA)

N73-30957# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

STRUCTURAL DYNAMICS OF A HELICOPTER ROTOR BLADE M.S. Thesis

Michael D. Rudy Jun. 1973 163 p refs

(Grant DA-ARO(D)-31-124-71-G13)

(AD-763934; PSU-AERSP-73-6; AROD-9334-2-E) Avail: NTIS CSCL 01/3

In the investigation of the structural dynamic problems associated with a helicopter rotor blade, a fully articulated rotor blade is considered in the analysis of the aeroelastic model. Therefore, there are three degrees of freedom considered; flapping, torsion, and lead-lag. The flapping and torsional motions are coupled inertially and the lead-lag motion is uncoupled from the other motions. The study is concerned with developing an aeroelastic model which takes into consideration the effects of the shearing force and rotary inertia upon the fundamental frequencies and mode shapes of the rotor blade. Also, the effect of inertial coupling between flapping and torsion on the fundamental frequencies and mode shapes is considered.

Author (GRA)

N73-30958# United Aircraft Corp., Stratford, Conn. Aircraft Div.

HELICOPTER GUST RESPONSE INCLUDING UNSTEADY AERODYNAMIC STALL EFFECTS Final Report

Russell R. Bergquist May 1973 57 p refs

(Contract DAAJ02-71-C-0024)

(AD-763957; USAAMRDL-TR-72-68) Avail: NTIS CSCL 01/1

The Sikorsky/UARL Normal Mode Rotor Aeroelastic Analysis (Computer Program Y-200) was modified to provide the capability of predicting the gust-response characteristics of pure and compound, single-rotor helicopters, including the effects of unsteady aerodynamics on rotor blade stall. The analysis was applied to examine the effects or rotor configuration, flight condition, and gust profile variables on rotor response characteristics. Only the short-term, controls-fixed response was investigated. The results were used to assess the accuracy of the gust-alleviation factor relation given by MIL-S-8698 (ARG) and USAAVLABS Technical Report 69-1 and to provide a basis for developing a more accurate relation. In addition, the impact of the gust on other quantities of interest such as blade vibratory moments and forces was briefly studied. Finally, an assessment of the relative importance of some of the assumptions in the analysis was also made. (Modified author abstract) GRA

N73-30959# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF KINEMATIC PARAMETERS OF A JET AIRCRAFT IN A TAKE-OFF RUN

D. S. Neklyudov 7 Jul. 1973 13 p refs Transl. into ENGLISH from Tr. Lvauga (USSR), no. 24, 1965 p 77-81

(AD-764314; FTD-HT-23-709-73) Avail: NTIS CSCL 01/2

The kinematic parameters of a jet aircraft in a take-off run are studied in the report. The method of the experimental study of parameters of a take-off run of an aircraft by means of the motion-picture recording of landing lights is examined. The experimental and theoretical examination of the problem leads to the construction of a certain universal dependence which can be used in the programming of the take-off run of a jet aircraft.

Author (GRA)

N73-30960# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

OPTIMAL LIFTING RE-ENTRY BY REDUCED-ORDER APPROXIMATION

W. ODwyer and H. Hinz May 1973 60 p refs

(AD-764132; RE-457) Avail: NTIS CSCL 01/2

A faster method for computing optimal three-dimensional trajectories that maximize the landing footprint of a lifting re-entry vehicle has been developed. The method uses energy approximations based on the assumption that the flight path angle is small and the flight path angular rate is zero. Thus, the vertical component of lift is considered equal to the weight minus centrifugal relief, and the equation of motion are reduced in order from six to four. Because of this simplification, the classical indirect method of the calculus of variations is used to compute

families of optimal solutions. Using data corresponding to one of the space shuttle configurations, computations have been carried out for both unconstrained trajectories and for solutions that have aerodynamic heating rates and lift coefficients limited to specified values. During the investigation, several interesting analytical finds were uncovered that could be used as a basis for an onboard guidance scheme. Author (GRA)

N73-30961# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SURFACE VELOCITIES AND TEMPERATURE CHANGES FOR C-130, C-141, AND C-5A EXHAUST BLASTS AND C-5A WING-TIP VORTEX Final Report
James W. Carr Jun. 1973 43 p refs
(DA Proj. 1T0-62112-A-131)
(AD-764228; AEWES-Misc-Paper-S-73-61) Avail: NTIS CSCL 01/2

The report describes a series of field investigations conducted to determine exhaust-blast velocities and temperatures at the ground level for various aircraft and the wing-tip vortex velocity of the C-5A. Measurements of exhaust-blast velocities and temperature rise during static conditions were collected for C-130, C-141, and C-5A aircraft. Taxi, breakway, and lift-off tests were conducted with the C-141 and C-5A to record velocity during actual aircraft operations. Wind velocity created by the wing-tip vortex of the C-5A was recorded during actual aircraft operations. Results of these tests indicate that temperature increases from engine exhaust blasts are not sufficient to cause detrimental effects on runway surfacing in use to date. (Modified author abstract) GRA

N73-30962# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
AN EXPERIMENTAL INVESTIGATION OF WIND TUNNEL WALL CORRECTIONS AND TEST LIMITS FOR V/STOL VEHICLES Final Report, 1 Jul. 1969 - 30 Jun. 1972
William H. Rae, Jr. and Shojiro Shindo 12 Jul. 1973 38 p refs
(Grant DA-ARO(D)-31-124-G809)
(AD-764255; AROD-4506-5-E) Avail: NTIS CSCL 01/3

The report deals with an experimental investigation of some of the problems associated with wind tunnel testing of V/STOL type aircraft. The models used in the study were either rotors or propellers acting as a rotor. Various size and shape wind tunnel test sections were simulated by the use of inserts installed within a larger main wind tunnel test section. The study investigated the application of wind tunnel wall corrections to models with large values of downwash. A physical limit, called flow breakdown, to the size and allowable downwash for a given model-tunnel combination was also studied. (Modified author abstract) GRA

N73-30963# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
WIND TUNNEL DRAG AND STABILITY OF SOLID FLAT CIRCULAR, T-10, AND RINGSLOT PARACHUTE MODELS WITH CENTERLINES Final Report, Jun. 1968 - Dec. 1972
H. G. Heinrich and R. A. Noreen May 1973 141 p
(Contract F33615-68-C-1227; AF Proj. 6065)
(AD-764364; AFFDL-TR-73-17) Avail: NTIS CSCL 01/3

Wind tunnel measurements of the aerodynamic force coefficients of solid flat circular, T-10, and ringslot parachute models with and without centerlines were made. Test conditions were M = 0.1 and Re/ft = 670,000 on models with a nominal diameter of approximately 16 in. The results showed general similarities in the effects of various centerline lengths on the different models. With centerline lengths about equal to the suspension line length, tangent force increases from 20% to 26% were obtained. At these configurations the force in the centerline is about one-half the total tangent force. The model trim angle and slope of the moment curve at that point were determined. These show the solid flat circular and T-10 models to be less stable, while the ringslot parameters were nearly unchanged. Author (GRA)

N73-30964# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
STUDIES IN LOW SPEED FLIGHT Final Report, 1 Oct. 1967 - 31 May 1973
Robert L. Carlson, Arnold L. Ducoffe, Robin B. Gray, James E. Hubbartt, and Howard M. McMahon Jun. 1973 27 p refs
(Contract DAHC04-68-C-0004)
(AD-764264; AROD-T-2-29-E) Avail: NTIS CSCL 01/3

Research studies on problems in low speed flight conducted under the THEMIS program are summarized for the period from 1 October 1967 to 31 May 1973. Results of investigations on heavily loaded ducted fans, vortex-wake analysis of a single-bladed hovering rotor, rotor blade flutter analyses, jet-in-crosswind, wall jets, and instability in tensioned sheets with cutouts are described. Lists of publications which describe the research are given and the faculty and student participation in the program is summarized. Author (GRA)

N73-30965# Technology, Inc., Dayton, Ohio.
OPERATIONAL USE OF UH-1H HELICOPTERS IN SOUTHEAST ASIA Final Report, 16 Apr. 1971 - 31 Oct. 1972
Raymond B. Johnson, Jr., Larry E. Clay, and Ruth E. Meyers May 1973 242 p refs
(Contract DAAJ02-71-C-0039; DA Proj. 1F1-62208-AA-82)
(AD-764260; USAAMRDL-TR-73-15) Avail: NTIS CSCL 01/2

From operational usage parameter measurements on three UH-1H helicopters, 203 hours of valid multichannel flight data were recorded while the helicopters operated from bases in Southeast Asia. Data were processed and analyzed according to four flight phases, called mission segments: ascent, maneuver, descent, and steady state. Data are presented in the form of time and occurrence tables, cumulative frequency distribution curves, and exceedance curves. These data indicate the time spent in the mission segments and parameter ranges; the number of peak parameter values occurring in the ranges of the given parameter during each of the mission segments, and in the ranges of one or more related parameters; and the time to reach or exceed given maneuver or gust normal load factors. The data presented were recorded between September 1971 and March 1972. Author (GRA)

N73-30966# Southwest Research Inst., San Antonio, Tex.
AN EXPERIMENTAL STUDY OF SKIRT FLUTTER ON SURFACE EFFECT TAKE-OFF LANDING (SETOL) CRAFT Final Report
R. L. Bass and J. E. Johnson Jun. 1973 61 p refs
(Contract N62269-73-C-0216)
(AD-764137) Avail: NTIS CSCL 01/3

The report summarizes all work performed in conducting an experimental study of surface effect take-off and landing (SETOL) craft skirt flutter. The test results reported were obtained utilizing two-dimensional models representing typical trunk segment configurations. Test results obtained with these models are being used to provide baseline flutter data for a corresponding theoretical effort. In addition to providing data for the theoretical work, these model tests were directed toward discovering the types of flutter oscillations that can occur, the mechanisms that are important in predicting the occurrence and magnitude of skirt flutter and the ranges of parameters over which flutter can occur. Author (GRA)

N73-30967# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
AN EVALUATION OF THE NEED FOR DECK MOTION PREDICTION ON THE WAVE-OFF ADVISORY SYSTEM Final Report
Ronald L. Nave 12 Jul. 1973 32 p
(AD-764516; NADC-73155-30) Avail: NTIS CSCL 01/2

A statistical model of the carrier wave-off situation is developed using experimentally measured data for carrier deck motion and aircraft approach geometry. This model is used to estimate the effect of ramp motion on the operation of the WOAS (Wave-Off Advisory System). In this manner the performance gains that could be achieved by adding a Deck Motion Prediction System to the WOAS are evaluated.
Author (GRA)

N73-30968# Army Foreign Science and Technology Center, Charlottesville, Va.
NONLINEAR VIBRATIONS OF PIPELINES CONTAINING

FLOWING FLUIDS
15 Mar. 1973 6 p refs Transl. into ENGLISH from Samoleto-stroenie i Tekhnika Vozdushnogo Flota (USSR), no. 21, 1970 p 56-58
(AD-764154; FSTC-HT-23-1974-72) Avail: NTIS CSCL 01/3
The report presents a study of the oscillations of aircraft hydraulic systems containing a pressurized fluid. GRA

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-30969# National Materials Advisory Board, Washington, D.C.
APPLICATION OF FRACTURE PREVENTION PRINCIPLES TO AIRCRAFT Final Report
Feb. 1973 274 p refs
(Contract DA-49-083-OSA-3131)
(AD-764513; NMAB-302) Avail: NTIS CSCL 01/3
The elements of current fracture control plans and associated technologies were reviewed. After reviewing the status, applicability, and potential of the elements and technologies, it was concluded that fracture control plans and development of related technologies not only afford an opportunity to reduce catastrophic failures of aircraft structures and structural maintenance but also can help to quantify many structural material, design, nondestructive evaluation, and maintenance decisions that now are made on a relatively qualitative basis. The Committee recommended careful trade studies, together with caution and flexibility, in the use of existing criteria and prior to the issuance of new criteria. (Modified author abstract) GRA

N73-30970# Grumman Aerospace Corp., Bethpage, N.Y.
TRACKED AIR CUSHION RESEARCH VEHICLE: DYNAMICS SIMULATION PROGRAM USER'S MANUAL Final Report
E. Magnani, R. Lee, and R. Coppolino Oct. 1973 206 p refs
(Contract DOT-FR-10039)
(PB-219984/2; PMT-B4-R72-07; FRA-RT-73-19) Avail: NTIS HC $3.00 CSCL 13F
A digital computer program was generated for use on the IBM 370/165 to evaluate the dynamic characteristics of the tracked air cushion research vehicle. The manual provides a summary review of the analytical basis, the construction of the computer program and the necessary instructions for the use of the program. The analytical model is formulated with the primary objective of obtaining vehicle ride qualities. The major vehicle components (body, chassis, guidance cushions and levitation cushions) supported by the vehicle suspension system are represented in a dynamic mathematical model with a maximum of twenty degrees of freedom. The non-linear response of this model to rigid and flexible guideway excitations, turn and superelevation excitations, and aerodynamic forces are obtained using numerical integration. Author (GRA)

N73-30971# Duke Univ., Durham, N.C. Dept. of Civil Engineering.
LOADING CRITERIA AND DYNAMIC RESPONSES OF A GUIDEWAY FOR AIR CUSHION VEHICLES Final Report
James F. Wilson Feb. 1973 69 p refs
(PB-221688/5; FRA-RT-73-32) Avail: NTIS HC $4.50 CSCL 13F
The purpose of the report is threefold: first, to review all available contract reports to determine loading criteria for proposed tracked air cushion vehicle guideways; second, to present methods for calculating dynamic responses of double-span beam-type guiderails and soil supported slabs subjected to high speed vehicle loading; and third, to obtain the dynamic load factors for the guiderail and slab components. Assuming that the post-supported guiderails are dynamically uncoupled from the slabs, dynamic load factors of up to 2.8 are calculated here for the rails, and these are in substantial agreement with previously reported results. (Modified author abstract) GRA

N73-30972 Ohio State Univ., Columbus.
STUDY OF THE ELECTROCHEMICAL EXCHANGE OF OXYGEN BETWEEN A SOLID ELECTROLYTE/POROUS PLATINUM ELECTRODE AND A FLOWING GAS Ph.D. Thesis
Edilberto Mogollon 1972 158 p
Avail: Univ. Microfilms Order No. 73-11545
The use of cylindrical ZrO2CaO solid electrolyte tubes as oxygen pumps, i.e., to add or remove oxygen to or from a flowing gas is considered. The rate controlling aspects of the pumping process are determined by the dependence of the pumping rate (current density) on the distance X, along the length of a cylindrical electrolyte tube as the solid electrolyte responds to an applied voltage. Dissert. Abstr.

N73-30973 Michigan Univ., Ann Arbor.
EXPERIMENTAL DETERMINATION OF DYNAMIC CHARACTERISTICS OF HYDROGEN OXYGEN FUEL CELL SYSTEMS Ph.D. Thesis
Bernard Ren Hao 1971 129 p
Avail: Univ. Microfilms Order No. 73-11307
Dynamic characteristics of aqueous electrolyte hydrogen-oxygen fuel cells were investigated at various cell temperatures, electrolyte concentrations, electrode spacings and type of electrodes. An electrical circuit was employed as a mathematical model in correlating the dynamic response of the test cell to the related system parameters. The voltage and current response of the fuel cell electrical circuit model was calculated under steady state discharge, charge and pulsed loading conditions. The calculated results were compared to the experimental data at the same conditions. The maximum deviation of the calculated cell voltage from the measured data at equal current load and time was less than + or - 5%. Dissert. Abstr.

N73-30974*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STORED CHARGED DEVICE Patent Application
Joseph Maserjian and George W. Lewicki, inventors (to NASA) Filed 25 Aug. 1971 28 p
(Contract NAS7-100)
(NASA-Case-NPO-11156-2; US-Patent-Appl-SN-174684) Avail: NTIS HC $3.50 CSCL 10A
The development of a stored charge device is discussed. A thin film metal layer is embedded between two insulating films used in a metal-nitride- oxide-silicon field effect transistor. The embedded metal layer provides a two-terminal, thin film, stored charge device which can be used in high density memory arrays. Drawings of the equipment and detiiled explanation of the operation are provided. P.N.F.

N73-30975# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
BIBLIOGRAPHIC COMPILATION AND TABULATION OF RESOURCES, OF THEIR CONSUMPTION AND THEIR WASTE IN THE WORLD [COMPILATION BIBLIOGRAPHIQUE ET TABULATION DES RESSOURCES, DE LA CONSOMMATION ET DES DECHETS DANS LE MONDE]
M. Roux Jul. 1973 66 p refs In FRENCH; ENGLISH summary
(LRP-63/73) Avail: NTIS HC $5.50
The available resources of fossil and nuclear fuels as well as those of solar energy, hydroelectric power and others are reviewed and compared to the global consumption of energy in the world, the USA, the Common Market and Switzerland. The per capita and global comsumption together with its growthrate, are presented and distributed with respect to primary energy sources and/or main sectors of use. Attention is focused on the energy required by the generatation of electrical power. Estimates up to the year 2000 are also given. Due to a twofold increase

both in the world population and in the per capita consumption, the energy demand by the year 2000 will be four times higher than its present level. Wastes from the nuclear economy are estimated up to the year 2000. The relative biological hazards pertaining to the radioactive inventories and wastes of fission reactors are compared to those of a reference fusion reactor.
Author

N73-30976*# Kanner (Leo) Associates, Redwood City, Calif.
PROJECT OF WIND MOTOR WITH AERODYNAMIC TRANSMISSION FOR CAPACITIES OF 100 kw TO 3000 kw
N. V. Krasovskiy Washington NASA Sep. 1973 21 p refs Transl. into ENGLISH from Izv. Otd. Tekh. Nauk, Akad. Nauk SSSR (USSR), no. 5, 1939 p 65-77
(Contract NASw-2481)
(NASA-TT-F-15131) Avail: NTIS HC $3.25 CSCL 10A

To reduce excessive weight requirements in the design of a 100-3000 kw capacity wind motor, aerodynamic transmission is employed. Aerodynamic transmission involves mounting secondary small windmills at the ends of the main wheel blades of the wind motor. The secondary small windmills operate in a high-velocity relative stream of 40-70 m/sec and can produce energy directly from the wind with the windmills turning at 500 or more rpm, with an efficiency of 80 percent or higher. Author

N73-30977*# Ion Physics Corp., Burlington, Mass.
DEVELOPMENT OF GALLIUM ARSENIDE SOLAR CELLS Final Report
Feb. 1973 43 p refs Sponsored by NASA, Prepared by JPL
(Contract JPL-953270)
(NASA-CR-135510) Avail: NTIS HC $4.25 CSCL 10A

The potential of ion implantation as a means of developing gallium arsenide solar cells with high efficiency performance was investigated. Computer calculations on gallium arsenide cell characteristics are presented to show the effects of surface recombination, junction space-charge recombination, and built-in fields produced by nonuniform doping of the surface region. The fabrication technology is summarized. Electrical and optical measurements on samples of solar cells are included. Author

N73-30978# Sandia Labs., Albuquerque, N.Mex.
INVESTIGATION OF MATERIALS TO IMMOBILIZE ELECTROLYTE IN PELLET-TYPE THERMAL BATTERIES
D. M. Bush Apr. 1973 33 p refs Sponsored by AEC
(SC-RR-66-202-A) Avail: NTIS HC $3.00

The clay, kaolin, is currently used to partially immobilize the electrolyte in pellet-type thermal batteries. Investigations were conducted to find a more efficient material, and one with lot-to-lot reproducibility better controlled. Twenty-nine materials were evaluated. Four of the most promising were similarly effective, immobilizing 31/2 times as much electrolytes as kaolin per unit weight. Using these more efficient materials, the activated life of single cells discharged between heated platens was increased as average of 43%. Author (NSA)

N73-30979# Engelhard Minerals and Chemicals Corp., Newark, N.J. Systems Dept.
OPEN CYCLE FUEL CELL POWER PLANT DIRECT CURRENTS, 1.5 KW Final Technical Report on phase 1, 1 Jul. 1970 - 30 Jun. 1971
O. J. Adlhart, M. F. Collins, R. Michalek, and P. L. Terry Jul. 1973 126 p refs
(Contract DAAK02-70-C-0517)
(AD-764285; SO-70-470-FR) Avail: NTIS CSCL 10/2

The report describes the design of an advanced development model of a portable field electrical power source capable of operation on logistic military fuels. The design was based on and substantiated by full size breadboard testing conducted concurrent with the design effort. The design of the 1.5 KW power plant was verified by the operation of a full scale breadboard system consisting of thermal cracker, fuel cell, and control module. The power conditioner was not tested in breadboard form. The switching transistor and drive circuitry, however, were tested on fuel cell output. Full scale breadboard testing of the integrated system was limited to 21 hours during which the system produced 1.25 KW at a fuel rate of 2.5 lbs/hr of JP-4. (Modified author abstract) GRA

N73-30980# ESB, Inc., Yardley, Pa.
MAGNESIUM FILM STUDY Semiannual Report, 15 May - 15 Nov. 1972
W. O. Butler, J. R. Dafler, J. B. Doe, and M. H. Hull Jul. 1973 128 p refs
(Contract DAAB07-72-C-0184; DA Proj. 1T6-62705-A-053)
(AD-764253; ECOM-0184-S-72; SAR-1) Avail: NTIS CSCL 10/3

The report discusses a study of the structure and composition of the various films that are formed on the magnesium dry cell anode prior to and during storage, and during discharge, for the purpose of eliminating or reducing the delayed action and the unproductive corrosion encountered in the magnesium dry cell. Special emphasis is placed upon correlation of test data with applicable dry cell parameters. (Modified author abstract) GRA

N73-30981# National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
BATTERIES USED WITH LAW ENFORCEMENT COMMUNICATIONS EQUIPMENT: CHARGERS AND CHARGING TECHNIQUES
W. W. Scott, Jr. Jun. 1973 49 p refs
(PB-221475/7; NBS-10732) Avail: NTIS HC $3.75 CSCL 10C

Basic charge characteristics of sealed nickel-cadmium and sealed lead-acid batteries and cells are considered. Methods of charging such batteries are presented along with advantages and disadvantages of different common charge systems. Fast charge systems are also discussed with emphasis on ways of determining when full charge on a battery is achieved.
Author (GRA)

N73-30982# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
LITHIUM-DOPED SILICON SOLAR CELLS STATE-OF-THE-ART Technical Report, Apr. - Oct. 1972
John M. Green Jun. 1973 43 p refs
(AF Proj. 3145)
(AD-764357; AFAPL-TR-73-4) Avail: NTIS CSCL 10/2

The present status of lithium-doped solar cells was investigated. Improvements in fabrication techniques have made possible lithium-doped cells which are 11.9% efficient at AMO conditions and 28 C. Cell areas of 12 square centimeters are now feasible. Annealing characteristics are highly temperature dependent with 60 C being the minimum array temperature for good performance. If the recovered power levels for N/P cells and P/N lithium-doped cells are compared for an array temperature of 80 C, it is found that the P/N lithium-doped cells are 15% higher after 10 to the 15th power/sq cm 1 Mev equivalent electrons and 85% higher after 10 to the 13th power/sq cm fission spectrum neutrons. Based on this survey the use of lithium-doped cells is recommended for missions which require solar arrays to operate at temperatures above 60 C, especially if the satellite must survive a nuclear weapon environment.
Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-30983# Joint Publications Research Service, Arlington, Va.
SPACE MEDICINE AND EXTRATERRESTRIAL LIFE
4 Sep. 1973 18 p refs Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 5, 1973 p 38-45
(JPRS-59952) Avail: NTIS HC $3.00

Selected articles on space biology, aerospace medicine, and human factors engineering are presented. For individual titles, see N73-30984 through N73-30986.

N73-30984 Joint Publications Research Service, Arlington, Va. **c05**
WORK AND REST SCHEDULE FOR COSMONAUTS
Ye. Karpov and V. Bodrov *In its* Space Med. and Extraterrestrial Life (JPRS-59952) 4 Sep. 1973 p 1-5 Transl. into ENGLISH

from Aviat. Kosmonavt. (USSR), no. 5, 1973 p 38-39 (For availability see N73-30983 22-04)

Fulfillment of the program of a space flight and its safety are determined, to a great extent, by the cosmonauts' schedule of labor and rest. When constructing a rational schedule, specialists strive to realize two primary goals: promote fulfillment by the cosmonauts of their occupational duties and insure preservation of the health and ability to work of the cosmonauts during the entire flight. The results of experimental research done under laboratory conditions and during actual space flights make it possible to recommend the following distribution of the daily time budget of each crew member: eight hours for work, eight hours for sleep, two hours and 15 minutes for eating (including 30 minutes apiece for early and late breakfasts and the evening meal, and 45 minutes for the main meal), 45 minutes for personal hygiene, and two hours and 30 minutes for personal time and active rest. Author

N73-30985 Joint Publications Research Service, Arlington, Va.
INVESTIGATING FOR LIFE ON OTHER PLANETS
L. Mukhin *In its* Space Med. and Extraterrestrial Life (JPRS-59952) 4 Sep. 1973 p 6-10 Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 5, 1973 p 40-41 (For availability see N73-30983 22-04)

Study of the planets of the solar system using unmanned space devices will make it possible to come to a complete decision on one of the most significant scientific problems, the search for life forms on other planets. The data obtained by the Soviet Venera and Mars stations and the Mariner spacecraft give little basis for optimistic conclusions concerning the existence of life on Mars and Venus. The high temperatures on the surface of Venus completely exclude the possibility of the existence of life systems built on a water-carbon basis. On Mars the limiting factors are strong shortwave solar radiation reaching the surface of the planet and the almost complete absence of free water. Scientists are continuing to investigate this problem. In the coming years experiments are planned to search for life on Mars. The discovery of nonterrestrial forms of life is such an important scientific problem that it has been recognized as necessary to undertake attempts in this direction even if there are very minimal chances of success. Author

N73-30986 Joint Publications Research Service, Arlington, Va.
USING ONBOARD RECORDS FOR MEDICAL PURPOSES
c05
N. Frolov *In its* Space Med. and Extraterrestrial Life (JPRS-59952) 4 Sep. 1973 p 11-14 Transl. into ENGLISH from Aviat. Kosmonaut. (USSR), no. 5, 1973 p 44-45 (For availability see N73-30983 22-04)

The extensive introduction of instruments for objective monitoring of flight parameters has made it possible to obtain certain statistically valid data characterizing crew activity in controlling the aircraft and engine and to determine deviations from assigned flight regimes. Data from experiments testify that the objective monitoring instruments are fully suitable for studying pilot activity in flight. They must be used more extensively in practical medical investigations of flights. Doctors will need additional knowledge and the ability to decipher the data of the onboard recorders. However, this will be paid back many times over by more purposeful and differentiated planning of the pilot training process, intensification of the process, and, what is perhaps the most important, it will make it possible to avoid those complications which come with approving for flight a pilot who does not yet have sufficiently well-formed habits. Author

N73-30987*# Naval Biomedical Research Lab., Oakland, Calif.
RELEASE OF BACTERIAL SPORES FROM THE INNER WALLS OF A STAINLESS STEEL CUP SUBJECTED TO THERMAL STRESSES AND MECHANICAL SHOCK
H. Wolochow, M. Chatigny, and J. Hebert Apr. 1973 24 p (NASA Order W-13450)
(NASA-CR-133868; NBRL-48th-TPR) Avail: NTIS HC $3.25 CSCL 06M

The release and fallout of particulates from surfaces afforded thermal or impact stress is of concern for control of contamination of Mars from planetary landing vehicles. A metal vessel contaminated by aerosols of spores was used as a model system and the fallout of spores as affected by various mechanisms was examined. Thermal stresses simulating those expected on the Mars lander dislodged approximately .01% of the aerosol deposited surface burden as did a landing shock of 8 to 10G deceleration. Spores imprinted by finger or swab contact yielded similar results. In all cases where repeated cycling of temperature, motion, or shock were employed the majority of fallout occurred in the first cycle. Particles released from the surface were predominantly in the size range 1 to 5 microns. Author

N73-30988*# Texas A&M Univ., College Station. Dept. of Plant Sciences.
ANALYTICAL AND RADIO-HISTO-CHEMICAL EXPERIMENTS OF PLANTS AND TISSUE CULTURE CELLS TREATED WITH LUNAR AND TERRESTRIAL MATERIALS
Final Report
Robert S. Halliwell [1973] 127 p refs
(Contract NAS9-12050)
(NASA-CR-134036; BB321-55-407P) Avail: NTIS HC $8.50 CSCL 06C

The nature and mechanisms of the apparent simulation of growth originally observed in plants growing in contact with lunar soil during the Apollo project quarantine are examined. Preliminary experiments employing neutron activated lunar soil indicate uptake of a few elements by plants. It was found that while the preliminary neutron activation technique allowed demonstration of uptake of minerals it presented numerous disadvantages for use in critical experiments directed at elucidating possible mechanisms of stimulation. Author

N73-30989# Civil Aeromedical Inst., Oklahoma City, Okla.
ALCOHOL AND DISORIENTATION RELATED RESPONSES. 6: EFFECTS OF ALCOHOL ON EYE MOVEMENTS AND TRACKING PERFORMANCE DURING LABORATORY ANGULAR ACCELERATIONS ABOUT THE YAW AND PITCH AXES
David J. Schroeder, Richard D. Gilson (Naval Aerospace Med. Res. Lab., Pensacola, Fla.), Frederick E. Guedry (Naval Aerospace Med. Res. Lab., Pensacola, Fla.), and William E. Collins Dec. 1972 15 p refs
(FAA-AM-72-34) Avail: NTIS HC $3.00

Twenty-four young men, equally divided into alcohol and control (no alcohol) groups, performed a compensatory tracking task while stationary and while oscillating about their pitch and their yaw axes in the USN Human Disorientation Device. Alcohol doses were 2.0 ml of vodka per kg of body weight and tests were conducted before drinking and 1, 2, and 4 hours after drinking. In the absence of motion, there was no difference between the groups in tracking error while subjects were in the pitch position; significantly more errors occurred for alcohol subjects in the yaw position one and four hours (but not two hours) after drinking. During motion, one and two hours after drinking, alcohol subjects performed significantly poorer than the nondrinkers and had significantly less control of their eye movements for both axes of stimulation. Absolute error was greater during all sessions for pitch-plane stimulation as compared with yaw-plane stimulation. These degrading effects of alcohol on performance, particularly evident during motion, are discussed from the viewpoint of aviation safety. Author

N73-30990*# Kanner (Leo) Associates, Redwood City, Calif.
FLUOROMETRIC 11-HYDROXY-CORTICOSTEROID ASSAY IN HUMAN BLOOD PLASMA
Ya. Popens, E. Silinsh, and I. Vitols Washington NASA Sep. 1973 13 p refs Transl. into ENGLISH from Vopr. Med. Khim. (Moscow), v. 14, no. 6, 1968 p 628-634
(Contract NASw-2481)
(NASA-TT-F-15092) Avail: NTIS HC $3.00 CSCL 06P

A fluorometric method for 11-hydrocorticosteroid determination in human blood plasma is described. A mixture of 60% sulfuric acid and 40% acetic acid was used as a specific fluorescent reagent. Sensitivity of the method if 0.02 micron of hydroxycortisone per ml. Mean probable error of a determination is 4.8%. Author

N73-30991*# Techtran Corp., Glen Burnie, Md.
V. V. STRELTSOV: THE FOUNDER OF THE SOVIET SCHOOL OF AVIATION-SPACE MEDICINE
Nikolay Aleksandrovich Agadzhanyan Washington NASA Oct.

1973 20 p refs Transl. into ENGLISH from Priroda (Moscow), no. 8, Aug. 1973 P 50-56
(Contract NASw-2485)
(NASA-TT-F-15101) Avail: NTIS HC $3.00 CSCL 04E

An account of the life and work of V. V. Strel'tsov in Soviet aviation medicine is given. Some works and contributions are cited, particularly studies of hypoxia and phylogenetic applications in aviation medicine. Author

N73-30992*# Techtran Corp., Silver Spring, Md.
THE SECOND ORBITAL FLIGHT
A. Nikolayev Washington NASA Sep. 1973 11 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 7, Jul. 1973 p 32-34
(Contract NASw-2485)
(NASA-TT-F-15076) Avail: NTIS HC $3.00 CSCL 06P

Two manned space flights are described, with emphasis on physical monitoring and aftereffects of the flights. Author

N73-30993*# Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF CORIOLIS ACCELERATION ON THE VESTIBULAR APPARATUS OF A COSMONAUT AND ITS EXPERIMENTAL STUDY IN THE LABORATORY
F. A. Solodovnik and L. M. Vorobyev Washington NASA Sep. 1973 14 p refs Transl. into ENGLISH from the publ. "Problemy Bioniki" Moscow, Nauka, 1973 p 53-58
(Contract NASw-2483)
(NASA-TT-F-15129) Avail: NTIS HC $3.00 CSCL 06S

Laboratory experiments were conducted to study the effects of Coriolis acceleration on the human vestibular apparatus. Rotation of the test subject in a chair was combined with simultaneous rotation (inclination) of his head in a plane containing the rotation axis of the chair in one case and with simultaneous translational displacement of the head in the other case. The directions of endolymph displacement in the semicircular canals under the action of Coriolis acceleration were determined by recording the horizontal nystagmus with the Neptune device. Author

N73-30994*# Scientific Translation Service, Santa Barbara, Calif.
SLEEP AND CEREBRAL TEMPERATURE IN THE RAT DURING THE CHRONIC EXPOSURE TO A HOT ENVIRONMENT
J. L. Valatx, B. Roussel, and M. Cure Washington NASA Sep. 1973 26 p refs Transl. into ENGLISH from Brain Res. Amsterdam, v. 55, 1973 p 107-122
(Contract NASw-2483)
(NASA-TT-F-15082) Avail: NTIS HC $3.50 CSCL 06C

The circadian rhythm of sleep and cerebellar temperature were studied in the rat during chronic heat exposure at 20 C, 25 C, 30 C, 34 C, and 36 C of ambient temperature. Cortical, electromyographic electrodes and thermistors were chronically implated. Continuous recordings were made from 30 male subjects for a 3-week period at each step of ambient temperature rise. Results show an increase of sleep time with ambient temperature rise with a maximum at 34 to 35 C. This increase was more important for paradoxical sleep (PS) than for slow wave sleep (SWS). The PS/SWS ratio was 13.6 at 20 C and 19.4 at 34 C. The large fluctuations in cerebellar temperature observed during sleep-waking cycles at 20 to 25 C were reduced at 34 C and 36 C. The mean cerebellar temperature increased with ambient temperature rise. A possible explanation is that in the albino rat without polypnea or sweating, an excessive central temperature rise induced by external thermal load could be prevented by a decrease in basal metabolism and motor activity. Author

N73-30995*# Behavioral Technology Consultants, Silver Spring, Md.
STATISTICAL EVALUATION OF TIME SERIES ANALYSIS TECHNIQUES
Vernon A. Benignus Jun. 1973 47 p refs
(Contract NAS9-12902)
(NASA-CR-134011) Avail: NTIS HC $4.50 CSCL 06P

The performance of a modified version of NASA's multivariate spectrum analysis program is discussed. A multiple regression model was used to make the revisions. Performance improvements were documented and compared to the standard fast Fourier transform by Monte Carlo techniques. E.H.W.

N73-30996*# Aerojet Medical and Biological Systems, El Monte, Calif.
TAPE CASSETTE BACTERIA DETECTION SYSTEM Final Report
27 Apr. 1973 93 p refs
(Contract NAS9-12548)
(NASA-CR-134035; Rept-1105-F) Avail: NTIS HC $6.75 CSCL 06M

The design, fabrication, and testing of an automatic bacteria detection system with a zero-g capability and based on the filter-capsule approach is described. This system is intended for monitoring the sterility of regenerated water in a spacecraft. The principle of detection is based on measuring the increase in chemiluminescence produced by the action of bacterial porphyrins (i.e., catalase, cytochromes, etc.) on a luminol-hydrogen peroxide mixture. Since viable as well as nonviable organisms initiate this luminescence, viable organisms are detected by comparing the signal of an incubated water sample with an unincubated control. Higher signals for the former indicate the presence of viable organisms. System features include disposable sealed sterile capsules, each containing a filter membrane, for processing discrete water samples and a tape transport for moving these capsules through a processing sequence which involves sample concentration, nutrient addition, incubation, a 4 Molar Urea wash and reaction with luminol-hydrogen peroxide in front of a photomultiplier tube. Liquids are introduced by means of a syringe needle which pierces a rubber septum contained in the wall of the capsule. Detection thresholds obtained with this unit towards E. coli and S. marcescens assuming a 400 ml water sample are indicated. Author

N73-30997*# Kanner (Leo) Associates, Redwood City, Calif.
METHODS OF DETERMINATION OF HYDROXYPROLINE IN BIOLOGICAL FLUIDS AND THEIR USE IN CLINICAL PRACTICE
A. A. Krel and L. N. Furtseva Washington NASA Sep. 1973 12 p refs Transl. into ENGLISH from Vopr. Med. Khim. (Moscow), v. 14, no. 6, 1968 p 635-640
(Contract NASw-2481)
(NASA-TT-F-15093) Avail: NTIS HC $3.00 CSCL 06P

A method is modified for determination of hydroxyproline bound to collagen-like plasma proteins and of total urine. The deviation in parallel tests averaged 2%. Values of both the content of plasma protein hydroxyproline and total urine hydroxyproline of normal individuals are given. Changes in the above values in collagenous and bone diseases are briefly discussed. Author

N73-30998*# Kanner (Leo) Associates, Redwood City, Calif.
FUNCTIONAL TEST WITH A WATER LOAD
Washington NASA Sep. 1973 4 p Transl. into ENGLISH of the publ. "Funktionalnaya Proba s Vodnoy Nagruzkov" Moscow, Acad. of Sci., 1973 3 p
(Contract NASw-2481)
(NASA-TT-F-15091) Avail: NTIS HC $3.00 CSCL 06P

A water load test was performed to evaluate the hydration status of the organism and the functional state of the kidneys and adrenals during the postflight period. The quantity of water injected was measured after which a precise analysis of the urine and blood was made. Author

N73-30999*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF IMMUNOLOGICAL REACTIVITY
Washington NASA Sep. 1973 7 p Transl. into ENGLISH of rept. "Issled. Immunol. Reaktivnosti" Moscow, Acad. Sci. USSR, 1973 6 p
(Contract NASw-2481)
(NASA-TT-F-15089) Avail: NTIS HC $3.00 CSCL 06E

The functional state is determined of the lymphoid cell population circulating in the peripheral blood of the astronauts after space flight. Peculiarities are reported of the process of readaptation of the lymphocytes to earth conditions for several weeks after space flight. Individual peculiarities are also reported of immunoreactivity of astronauts, reflecting changes in the rate of synthesis of RNA and DNA in T-lymphocytes after space flights. Author

N73-31000*# Montana Univ., Missoula.
TELEMETRY EXPERIMENTS WITH A HIBERNATING BLACK BEAR Progress Report
J. J. Craighead, J. R. Varney, J. S. Sumner, and F. C. Craighead, Jr. 30 Jun. 1972 36 p refs
(Grant NGR-27-002-006)
(NASA-CR-133926) Avail: NTIS HC $4.00 CSCL 06C

The objectives of this research were to develop and test telemetry equipment suitable for monitoring physiological parameters and activity of a hibernating bear in its den, to monitor this data and other environmental information with the Nimbus 3 IRLS data collection system, and to refine immobilizing, handling, and other techniques required in future work with wild bears under natural conditions. A temperature-telemetering transmitter was implanted in the abdominal cavity of a captive black bear and body temperature data was recorded continuously during a 3 month hibernation period. Body temperatures ranging between 37.5 and 31.8 C were observed. Body temperature and overall activity were influenced by disturbances and ambient den temperature. Nychthemeral temperature changes were not noticable. A load cell weight recording device was tested for determining weight loss during hibernation. Monitoring of data by satellite was not attempted. The implanted transmitter was removed and the bear was released with a radiolocation collar at the conclusion of the experiment. Author

N73-31001*# Research Triangle Inst., Research Triangle Park, N.C.
NASA APPLICATION TEAM PROGRAM: APPLICATION OF AEROSPACE TECHNOLOGY IN BIOLOGY AND MEDICINE Final Report, Sep. 1972 - Aug. 1973
31 Aug. 1973 111 p
(Contract NASw-2459)
(NASA-CR-135527) Avail: NTIS HC $7.75 CSCL 06E

The results of the medically related activities of the NASA Application Team Program in technology application for the reporting period September 1, 1972, to August 31, 1973 are reported. The accomplishments of the application team during the reporting period are as follows: The team has identified 39 new problems for investigation, has accomplished 7 technology applications, 4 potential technology applications, 2 impacts, has closed 38 old problems, and has a total of 59 problems under active investigation. Author

N73-31002*# BioTechnology, Inc., Falls Church, Va.
A REVIEW OF THE INFLUENCE OF PHYSICAL CONDITION PARAMETERS ON A TYPICAL AEROSPACE STRESS EFFECT: DECOMPRESSION SICKNESS Final Report
Vita R. West and James F. Parker, Jr. Jun. 1973 54 p refs Sponsored in part by NASA
(Contract N00014-72-C-0263; NR Proj. 309-029)
(NASA-CR-135495; AD-763453) Avail: NTIS HC $4.75 CSCL 06/14

The study examines data on episodes of decompression sickness, particularly from recent Navy work in which the event occurred under multiple stress conditions, to determine the extent to which decompression sickness might be predicted on the basis of personal characteristics such as age, weight, and physical condition. Such information should ultimately be useful for establishing medical selection criteria to screen individuals prior to participation inactivities involving extensive changes in ambient pressure, including those encountered in space operations. The main conclusions were as follows. There is a definite and positive relationship between increasing age and weight and the likelihood of decompression sickness. However, for predictive purposes, the relationship is low. To reduce the risk of bends, particularly for older individuals, strenuous exercise should be avoided immediately after ambient pressure changes. Temperatures should be kept at the low end of the comfort zone. For space activities, pressure changes of over 6-7 psi should be avoided. Prospective participants in future missions such as the Space Shuttle should not be excluded on the basis of age, certainly to age 60, if their general condition is reasonably good and they are not grossly obese. (Modified author abstract) GRA

N73-31003# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTIBILITY AND TOXICITY OF METALS AND ALLOYS, SELECTED ARTICLES
B. M. Zlobinskii, V. G. Ioffe, and V. B. Zlobinskii 29 Jun. 1973 151 p Transl. into ENGLISH of the mono. "Vosplamenyaemost i Toksichnost Metallov i Splavov" Moscow, 1972 p 21-25, 106-126, 191-200, 204-263
(AD-764284; FTD-MT-24-211-73) Avail: NTIS CSCL 06/20

The topics in the report include the following: ignition models; combustibility of mechanical mixtures of powdered metal; diagram of combustibility; mechanism of ignition and burning of powdered metals; mechanism of ignition and burning of aerosols of metals; inter connection between characteristics of the combustibility of aerogels and aerosols of metals; general information of toxicity; classification of substances according to the degree of danger; characteristics of the toxicity; of metals; and characteristics of metals with respect to the danger of their effect. Author (GRA)

N73-31004# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE MEASUREMENT OF PULMONARY EXTRAVASCULAR WATER VOLUME DURING EXPOSURE TO SIMULATED HIGH ALTITUDE
Raphael F. Smith and Lloyd H. Ramsey 3 Jan. 1973 17 p refs
(MR0410101)
(AD-763355; NAMRL-1176) Avail: NTIS CSCL 06/19

To investigate basic mechanisms operative in high altitude pulmonary edema, pulmonary extravascular water volume (Qpevw) was measured in 11 unanesthetized calves exposed to atmospheres equivalent to 12,000 and 16,000 feet. Measurements were made by a double indicator dilution technique at sea level and after continuous exposure of 24, 48, and 72 hours. Thirty-five duplicate measurements from 15 experiments yielded a test-retest reliability coefficient of 0.84. Data from 15 experiments were technically satisfactory after exposure of 24 hours; 13 experiments after 48 hours exposure; and 7 experiments after 72 hours exposure. After 24 hours exposure the mean increase in Qpevw was 42.7 ml (p-.025); after 48 hours 79.3 ml (p-.005); and after 72 hours, 29.3 ml (N.S.). There was no significant difference in Qpevw for the same duration of exposure at 12,000 feet and 16,000 feet. It is concluded that Qpevw increases in the bovine lung after exposure to high altitude.
Author (GRA)

N73-31005# Naval Submarine Medical Research Lab., Groton, Conn.
THE BOHR EFFECT IN CHRONIC HYPERCAPNIA Medical Research Progress Report No. 3
Arthur A. Messier and Karl E. Schaefer 13 Dec. 1972 17 p refs
(AD-763394; NSMRL-732) Avail: NTIS CSCL 06/19

The study investigates whether the changes in oxygen affinity produced by exposure to 15% CO2, which affects oxygen transport by reducing oxygen delivery at the tissue level, would be compensated by changes in the Bohr effect. The Bohr effect showed a marked increase during chronic exposure to 15% CO2. The effective Bohr effect, which is the additional oxygen released at 50% oxyhemoglobin saturation (P50) when blood is acidified from pH 7.4 to 7.3, was found to be elevated during the periods of greatest respiratory stress. These findings are of interest to personnel concerned with toxicological aspects of increased carbon dioxide exposure as potentially found in Navy submarine and diving environments as well as other hazards which might induce an acidosis such as hyperbaric hyperoxia. GRA

N73-31854 National Research Council of Canada, Ottawa (Ontario). Control System Lab.
SLEEP DEPRIVATION EFFECTS ON ACCURACY AND SPEED OF RESPONSE SELECTION AND EXECUTION
Leslie Buck *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 1-12 refs (For availability see N73-31853 22-34)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-31006*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
ICE PACK HEAT SINK SUBSYSTEM - PHASE 1, VOLUME 1
George J. Roebelen, Jr. Jun. 1973 210 p refs 2 Vol.
(Contract NAS2-7011)
(NASA-CR-114624-Vol-1; SVHSER-6223-Vol-1) Avail: NTIS HC $12.50 CSCL 06K

The design, development, fabrication, and test at one-g of a functional laboratory model (non-flight) ice pack heat sink subsystem to be used eventually for astronaut cooling during manned space missions are discussed. In normal use, excess heat in the liquid cooling garment (LCG) coolant is transferred to a reusable/regenerable ice pack heat sink. For emergency operation, or for extension of extravehicular activity mission time after all the ice has melted, water from the ice pack is boiled to vacuum, thereby continuing to remove heat from the LCG coolant. This subsystem incorporates a quick connect/disconnect thermal interface between the ice pack heat sink and the subsystem heat exchanger. Author

N73-31007*# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
STUDY OF SPACE SHUTTLE EVA/IVA SUPPORT REQUIREMENTS. VOLUME 2: EVA/IVA TASKS, GUIDELINES, AND CONSTRAINTS DEFINITION
B. W. Webbon, R. J. Copeland, P. W. Wood, Jr., and R. L. Cox 30 Apr. 1973 289 p refs
(Contract NAS9-12507)
(NASA-CR-133992; T-192-RP05-Vol-2) Avail: NTIS HC $16.50 CSCL 22B

The guidelines for EVA and IVA tasks to be performed on the space shuttle are defined. In deriving tasks, guidelines, and constraints, payloads were first identified from the mission model. Payload requirements, together with man and manipulator capabilities, vehicle characteristics and operation, and safety considerations led to a definition of candidate tasks. Guidelines and constraints were also established from these considerations. Scenarios were established, and screening criteria, such as commonality of EVA and IVA activities, were applied to derive representative planned and unplanned tasks. The whole spectrum of credible contingency situations with a potential requirement for EVA/IVA was analyzed. Author

N73-31008*# ILC Industries, Inc., Dover, Del.
STUDY OF SPACE SHUTTLE EVA/IVA SUPPORT REQUIREMENTS. VOLUME 3: REQUIREMENTS STUDY FOR SPACE SHUTTLE PRESSURE SUITS Final Report
19 Dec. 1972 261 p refs Prepared for LTV Aerospace Corp., Dallas
(Contract NAS9-12507; LTVAC Order 826814-UZ)
(NASA-CR-133993; ER-051-01; T-192-RP05-Vol-3) Avail: NTIS HC $15.25 CSCL 06K

The performance and design requirements for the space shuttle EVA and IVA pressure suits were investigated. A systems analysis was conducted to determine the characteristics and human factors design considerations for the pressure suit. The three major topics considered are: (1) mission parameters, (2) suit requirements, and (3) utilization of contemporary suit designs. The distinct and separate needs of all crew members, passengers, and/or EVA crewman were analyzed. Author

N73-31009*# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
STUDY OF SPACE SHUTTLE EVA/IVA SUPPORT REQUIREMENTS. VOLUME 4: REQUIREMENTS STUDY FOR SPACE SHUTTLE MOBILITY AIDS
P. W. Wood, Jr. 30 Apr. 1973 147 p refs
(Contract NAS9-12507)
(NASA-CR-133994; T-192-RP05-Vol-4) Avail: NTIS HC $9.50 CSCL 06K

The requirements for mobility aids and restraint devices for use by personnel of the space shuttle were investigated. The devices considered were as follows: (1) translational devices to assist crewmen in moving from place to place and in moving equipment, (2) restraint devices for crewman at the worksite to prevent undesired induced motion between the crewman and the worksite, and (3) other necessary worksite provisions. Existing devices in each category are reviewed and new concepts are generated as required. Diagrams and line drawings of items of equipment are provided. Author

N73-31010*# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
STUDY OF SPACE SHUTTLE EVA/IVA SUPPORT REQUIREMENTS. VOLUME 5: REQUIREMENTS STUDY FOR SPACE SHUTTLE EMERGENCY 4 SUPPORT
R. J. Copeland and R. L. Cox 30 Apr. 1973 200 p refs
(Contract NAS9-12507)
(NASA-CR-133995; T-192-RP05-Vol-5) Avail: NTIS HC $12.00 CSCL 06K

The requirements for space shuttle emergency intravehicular activity support equipment are discussed. The potential emergencies considered are: (1) contaminated atmosphere, (2) accidental decompression, (3) inability to re-enter, and (4) crewman stranded. Contingency life support systems are described and the effectiveness of each emergency procedure is analyzed. Author

N73-31011*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RAW LIQUID WASTE TREATMENT SYSTEM AND PROCESS Patent Application
Marshall F. Humphrey, inventor (to NASA) Filed 22 Aug. 1973 24 p
(Contract NAS7-100)
(NASA-Case-NPO-13224-1; US-Patent-Appl-SN-390467) Avail: NTIS HC $3.25 CSCL 06I

A description is given of a raw sewage treatment process where all organic matter is dissolved in the sewage liquid. All non-dissolved matter suspended in the sewage is pyrolyzed to form an activated carbon and ash materials without addition of any conditioning agents. The activated carbon and ash material is added to the water from which the non-dissolved matter was removed. The activated carbon and ash material adsorbs the organic matter which is dissolved in the water and is thereafter supplied in a counter current flow direction, and combines with the incoming raw sewage to facilitate the separation of non-dissolved settleable materials from the sewage water. The used carbon and ash material together with the non-dissolved matter which was separated from the sewage water are pyrolyzed to form the activated carbon and ash material. NASA

N73-31012*# Purdue Univ., Lafayette, Ind.
HEATING OF FOOD IN MODIFIED ATMOSPHERES Final Report
Vincent E. Sweat [1973] 116 p refs
(Contract NAS9-10823)
(NASA-CR-134040) Avail: NTIS HC $8.00 CSCL 06H

Food heating tests were conducted with two model foods; a Carnation turkey salad sandwich spread and frankfurter chunks in a sauce of water and agar. For the first series of tests comparing heating in five different atmospheres, the atmospheres were: (1) air at atmospheric pressure, (2) air at 5 psia, (3) helium at 5 psia, (4) oxygen-nitrogen mixture at 5 psia, and (5) oxygen-helium mixture at 5 psia. No significant differences in heating rates were caused by varying the atmosphere. Initial food temperatures were varied in the next series of tests. Heating times were found to increase with decreasing initial temperatures. There were also differences in heating times between the two foods used. Author

N73-31013*# Energy Research Corp., Bethel, Conn.
CARBON DIOXIDE ADSORBENT STUDY Final Report
Michael Onischak and Bernard S. Baker Sep. 1973 47 p refs
(Contract NAS2-7023)
(NASA-CR-114661) Avail: NTIS HC $4.50 CSCL 06K

A study was initiated on the feasibility of using the alkali

metal carbonate - bi-carbonate solid-gas reaction to remove carbon dioxide from the atmosphere of an EVA life support system. The program successfully demonstrates that carbon dioxide concentrations could be maintained below 0.1 mole per cent using this chemistry. Further a practical method for distributing the carbonates in a coherent sheet form capable of repeated regeneration (50 cycles) at modest temperatures (423 K), without loss in activity was also demonstrated. Sufficiently high reaction rates were shown to be possible with the carbonate - bi-carbonate system such that EVA hardware could be readily designed. Experimental and design data were presented on the basis of which two practical units were designed. In addition to conventional thermally regenerative systems very compact units using ambient temperature cyclic vacuum regeneration may also be feasible. For a one man - 8 hour EVA unit regenerated thermally at the base ship a system volume of 14 liters is estimated. Author

N73-31014# Aeronautical Research Labs., Melbourne (Australia).
THE PROTECTIVE PERFORMANCE OF CRASH HELMETS
S. R. Sarrailue Mar. 1973 41 p refs
(ARL/SM-Note-390) Avail: NTIS HC $4.25

Crash helmets for use in agricultural aviation should provide good impact protection, be light and comfortable and give acoustical protection. Satisfactory impact protection should be assured by standard specifications. To examine the performance of current helmets and suitability of typical standards, a series of tests was conducted on ten types of helmet, and their performance was compared with standard requirements and head tolerance to impact: Standard specifications were reviewed and it was concluded that they should, and could, be modified to require improved protection. The comfort aspects were investigated in a brief field trial to indicate design characteristics suitable for aviation helmets. Author

N73-31015*# Kanner (Leo) Associates, Redwood City, Calif.
SOME PROPERTIES OF A MATHEMATICAL ANALOG OF THE CENTRAL PORTION OF A VESTIBULAR ANALYZER
O. G. Gazenko and N. A. Chekhonadskiy Washington NASA Sep. 1973 15 p refs Transl. into ENGLISH of the book "Problemy Bioniki" Moscow, Nauka Press, 1973 p 45-53
(Contract NASw-2481)
(NASA-TT-F-15130) Avail: NTIS HC $3.00 CSCL 06B

Neuron response in the central region of a vestibular analyzer on exposure to periodically-varying acceleration is analyzed by mathematical simulation methods. The firing rate of the otolith receptors during oscillatory vertical movement is shown to vary sinusoidally with the same frequency of the oscillatory vertical movement. However, the firing rate does exhibit a phase shift relative to the vertical acceleration: the phase shift is dependent on the time constant of the otolith receptors. The two types of otolith receptors (one type located at the anterior macular crista and the other in the center of the macula) differ by their time constants. Author

N73-31016*# General Electric Co., Philadelphia, Pa.
WATER RECOVERY AND SOLID WASTE PROCESSING FOR AEROSPACE AND DOMESTIC APPLICATIONS. VOLUME 2: APPENDICES
R. W. Murray 21 May 1973 127 p
(Contract NAS9-12505)
(NASA-CR-134027; DOC-73SD4236-Vol-2) Avail: NTIS HC $8.50 CSCL 06I

Water and sewage treatment systems are presented with concentration on the filtration of water. Equipment is described for organic removal, solids removal, nutrient removal, inorganic removal, and disinfection of the water. Such things as aseline hardware, additional piping connections, waste disposal, and costs involved are also reported. T.M.R.

N73-31017*# General Electric Co., Philadelphia, Pa. Space Div.
WATER RECOVERY AND SOLID WASTE PROCESSING FOR AEROSPACE AND DOMESTIC APPLICATIONS. VOLUME 1: FINAL REPORT
R. W. Murray 21 May 1973 155 p
(Contract NAS9-12505)
(NASA-CR-134028; DOC-73SD4236-Vol-1) Avail: NTIS HC $9.75 CSCL 06I

A comprehensive study of advanced water recovery and solid waste processing techniques employed in both aerospace and domestic or commercial applications is reported. A systems approach was used to synthesize a prototype system design of an advanced water treatment/waste processing system. Household water use characteristics were studied and modified through the use of low water use devices and a limited amount of water reuse. This modified household system was then used as a baseline system for development of several water treatment waste processing systems employing advanced techniques. A hybrid of these systems was next developed and a preliminary design was generated to define system and hardware functions. Author

N73-31018*# MSA Research Corp., Evans City, Pa.
DEVELOPMENT OF SYSTEM DESIGN INFORMATION FOR CARBON DIOXIDE USING AN AMINE TYPE SORBER Final Report, 18 Nov. 1969 - 12 Feb. 1971
R. L. Rankin, F. Roehlich, and F. Vancheri 15 Jun. 1971 91 p refs
(Contract NAS1-7263)
(NASA-CR-111849) Avail: NTIS HC $6.75 CSCL 06K

Development work on system design information for amine type carbon dioxide sorber is reported. Amberlite IR-45, an aminated styrene divinyl benzene matrix, was investigated to determine the influence of design parameters of sorber particle size, process flow rate, CO2 partial pressure, total pressure, and bed designs. CO2 capacity and energy requirements for a 4-man size system were related mathematically to important operational parameters. Some fundamental studies in CO2 sorber capacity, energy requirements, and process operation were also performed. Author

N73-31019*# Martin Marietta Corp., Denver, Colo.
DESIGN, FABRICATION AND ACCEPTANCE TESTING OF A ZERO GRAVITY WHOLE BODY SHOWER, VOLUME 1 Final Report
Jul. 1973 216 p refs
(Contract NAS1-11339)
(NASA-CR-134066; MCR-73-172-Vol-1) Avail: NTIS HC $13.00 CSCL 06I

The effort to design whole body shower for the space station prototype is reported. Clothes and dish washer/dryer concepts were formulated with consideration given to integrating such a system with the overall shower design. Water recycling methods to effect vehicle weight savings were investigated and it was concluded that reusing wash and/or rinse water resulted in weight savings which were not sufficient to outweigh the added degree of hardware complexity. The formulation of preliminary and final designs for the shower are described. A detailed comparison of the air drag vs. vacuum pickup method was prepared that indicated the air drag concept results in more severe space station weight penalties; therefore, the preliminary system design was based on utilizing the vacuum pickup method. Tests were performed to determine the optimum methods of storing, heating and sterilizing the cleansing agent utilized in the shower; it was concluded that individual packages of pre-sterilized cleansing agent should be used. Integration features with the space station prototype system were defined and incorporated into the shower design as necessary. Author

N73-31020*# Essex Corp., Alexandria, Va.
THE ROLE OF MAN IN FLIGHT EXPERIMENT PAYLOAD MISSIONS. VOLUME 1: RESULTS
Thomas B. Malone Aug. 1973 34 p 2 Vol.
(Contract NASw-2389)
(NASA-CR-135487) Avail: NTIS HC $3.75 CSCL 05E

It is pointed out that a controversy exists concerning the required role of man, and his attendant skills and levels of skills, for Sortie Lab operations. As a result, a study was conducted to generate a taxonomy of candidate crew roles which would: (1) be applicable across all experiments, and (2) be usable for Sortie scientists and engineers in determination of level of skill as well as type of skill. Nine basic roles were identified in the study, and the tasks associated with each were developed from a functional description of a generalized in-flight experiment.

The functional analysis comprised the baseline for establishment of crew roles, with roles being defined as combinations of tasks, associated skills, and knowledges. A role classification scheme was developed in which the functions and tasks identified were allocated to each of the nine role types. This classification scheme is presented together with the significant results of the study. D.L.G.

N73-31021*# Essex Corp., Alexandria, Va.
THE ROLE OF MAN IN FLIGHT EXPERIMENT PAYLOAD MISSIONS. VOLUME 2: APPENDICES
Thomas B. Malone Aug. 1973 84 p 2 Vol.
(Contract NASw-2389)
(NASA-CR-135488) Avail: NTIS HC $6.25 CSCL 05E

In the study to determine the role of man in Sortie Lab operations, a functional model of a generalized experiment system was developed. The results are presented of a requirements analysis which was conducted to identify performance requirements, information requirements, and interface requirements associated with each function in the model. D.L.G.

N73-31022# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
CHANGE IN CIRCADIAN RHYTHM OF PSYCHOMOTOR PERFORMANCE AFTER TRANSMERIDIAN FLIGHTS Ph.D. Thesis - Bonn Univ.
Michael Bodanowitz 6 Mar. 1973 48 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-52) Avail: NTIS HC $4.50; DFVLR, Porz, West Ger. 15,30 DM

Psychomotor performance of eight students was studied at 3 hour intervals during periods of 24 hours before and after flights between Germany and the U.S.A. Two 24 hour preflight periods revealed the basic normal daily rhythm of the psychomotor performance. Effects of a 6 hour time shift were evaluated by determining the psychomotor performance on day 1, 3, 5, and 8 following the flights in each direction. A desynchronization with local time was observed after flights in both directions. The changes were more pronounced and longer lasting after the west-east flight. The resychronization-time amounted to 5 days after the westward travel and 8 days after the eastward flight. Author (ESRO)

N73-31023# Royal Naval Personnel Research Committee, London (England).
PERCEPTUAL CONFUSIONS BETWEEN FOUR-DIMENSIONAL SOUNDS
J. C. Webster, Muriel M. Woodhead, and Alan Carpenter Med. Res. Council Aug. 1971 23 p refs
(OES-6/72; BR-35741) Avail: NTIS HC $3.25

Whether the main characteristics of nonspeech sounds are identified in the same way as those of speech was investigated. If so, it would be useful to transform marine sounds into a speech mode for analysis. The dimensions were source waveform, fundamental frequency, and formant number and position of sixteen steady-state meaningless complex sounds, incorporating speech-like and engine-like aspects. Waveform and fundamental frequency were shown to be less confusing than formant changes. Thus, the nonspeech sounds were not perceived in the same way as speech. ESRO

N73-31024# Royal Naval Personnel Research Committee, London (England).
EFFICIENCY IN HEAT AFTER A NIGHT WITHOUT SLEEP
E. C. Poulton, R. S. Edwards, and W. P. Colquhoun Med. Res. Council Dec. 1971 34 p refs
(OES-8/72; BR-35739) Avail: NTIS HC $3.75

Twelve naval ratings performed 3 tasks after 1 night without sleep, in moderate heat of 38/32 C (100/90F), and with 2 stresses combined, as well as a control condition. The 3 tasks were tracking, in order: tracking with peripheral lights, the 5 choice task, and an auditory vigilance task. There was a reliable interaction between the 2 stresses, but only at the start of the auditory vigilance task. The detrimental effect of the 2 stresses combined was reliably less than the sum of the 2 separate detrimental effects. Since by definition loss of sleep reduces the level of arousal, it is concluded that mild heat must increase arousal. On the 5 choice task, both the loss of sleep and the heat had an immediate reliable effect as soon as the ratings started work. The combined effect of the 2 stresses increased reliably less over time than did the sum of the 2 separate stresses. On the tracking with peripheral lights and on the auditory vigilance task, the trends were reversed. Loss of sleep and heat did not have much immediate effect, and the combined effect of the 2 stresses increased reliably more over time than did the sum of the 2 separate effects. Author (ESRO)

N73-31025# Naval Postgraduate School, Monterey, Calif.
CURRENT VERSUS STAGNANT JET PILOTS' RESPONSE TIMES: A COMPARISON M.S. Thesis
John H. Smittle Mar. 1973 40 p refs
(AD-761463) Avail: NTIS CSCL 05/9

An attempt was made to determine if one of the basic piloting skills was lost during prolonged periods of nonflying. Current and stagnant groups of jet Naval aviators were tasked with responding to a sequence of sixty slides of an aircraft attitude indicator. The Subjects' response times were measured. The slides depicted twelve different aircraft attitudes. Although no significant difference was found between groups, a definite learning trend was established. The subjects were reassigned into more experienced and less experienced groups. The more experienced group performed significantly better. Author (GRA)

N73-31026# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
INSULATION OF LIQUID OXYGEN DEWARS Final Report
Charles F. Sindt Apr. 1973 46 p refs Previously announced as COM-73-10761
(NBS Proj. 2750554; NAEC Proj. PO-2-8061)
(AD-763325; NBSIR-73-308; COM-73-10761) Avail: NTIS CSCL 06/11

The Navy has experienced failure of vacuum insulation in dewars used for storage and handling of liquefied breathing oxygen for aircraft pilots. Because of the vacuum insulation failures, a search was made for a more rugged insulation that has thermal performance similar to the currently used vacuum with multilayer or powder. No system was found that compared in thermal performance and did not require a vacuum. Two systems were experimentally evaluated that did not require vacuum. One was polyurethane foam with an intermediate fiber glass shell and the other was glass bubbles in argon gas at one atmosphere pressure. The polyurethane foam system was successful in that no cracks penetrated to the outside surface; however, the average thermal conductivity was about 15 times greater than vacuum and powder. (Modified author abstract) GRA

N73-30984 Joint Publications Research Service, Arlington, Va.
WORK AND REST SCHEDULE FOR COSMONAUTS
Ye. Karpov and V. Bodrov *In its* Space Med. and Extraterrestrial Life (JPRS-59952) 4 Sep. 1973 p 1-5 Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 5, 1973 p 38-39 (For availability see N73-30983 22-04)

N73-30986 Joint Publications Research Service, Arlington, Va.
USING ONBOARD RECORDS FOR MEDICAL PURPOSES
N. Frolov *In its* Space Med. and Extraterrestrial Life (JPRS-59952) 4 Sep. 1973 p 11-14 Transl. into ENGLISH from Aviat. Kosmonaut. (USSR), no. 5, 1973 p 44-45 (For availability see N73-30983 22-04)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-31027# State Univ. of New York, Stony Brook.
SOLUBILITY AND THERMODYNAMIC PROPERTIES OF OXYGEN IN SOLID MOLYBDENUM Ph.D. Thesis
Satish Chandra Srivastava 1972 72 p
Avail: Univ. Microfilms Order No. 73-12079

Solid solubility of oxygen in molybdenum has been determined by equilibrium zone refined molybdenum rods with a powder

mixture of Mo + MoO2 in evacuated and sealed molybdenum capsules. Oxygen content of the rods was determined by inert gas fusion method. A least square fit through the experimental points gives the terminal solubility as 17.88 - 27,900/T, with T in degrees Kelvin. This solubility equation was used to calculate partial molar enthalpy and excess partial molar entropy of oxygen in solid solution from phase diagram by using the standard free energy of formation of equilibrium oxide phase MoO2. The values obtained for these parameters are -13.6 kcal and -10.6 cal/deg, respectively, when 1/2 mole of oxygen is dissolved in solid solution in molybdenum. Dissert. Abstr.

N73-31028 Ohio State Univ., Columbus.
ELECTROCHEMICAL STUDIES OF METALS IN FUSED SODIUM HYDROXIDE Ph.D. Thesis
George John Theus 1972 328 p
Avail: Univ. Microfilms Order No. 73-11590

Thermodynamic stability diagrams have been developed for iron, nickel, and chromium in fused sodium hydroxide using various empirical thermodynamic methods. The validity of these diagrams was tested at selected values of hydrogen and oxygen concentrations using various electrochemical techniques. In order to compare the experimental results with the predicted behavior, it was necessary to develop a reference electrode having a known potential with respect to that of the hydrogen electrode. The experimental results show that an oxygen electrode exists on a gold substrate in fused sodium hydroxide when an oxygen rich atmosphere is present; and a hydrogen electrode exists in a hydrogen rich atmosphere. Further evidence that these electrodes are the operating ones is shown by the transpassive behavior of the electrochemical polarization experiments. Dissert. Abstr.

N73-31029# Australian Post Office Research Labs., Melbourne.
ANALYSIS OF ANTIOXIDANTS USED IN POLYOLEFINS
D. T. Miles Aug. 1972 33 p refs Original contains color illustrations
(Rept-6726) Avail: NTIS HC $3.75

A method capable of both qualitative and quantitative analysis of antioxidants used in polyolefinic polymers is presented. Author

N73-31030*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMOTRANSPORT IN LIQUID ALUMINUM-COPPER ALLOYS
B. N. Bhat Washington Sep. 1973 13 p refs
(NASA-TR-R-415; M-702) Avail: NTIS HC $2.75 CSCL 11F

A thermotransport study was made on a series of liquid aluminum-copper alloys which contained from trace amounts to 33 weight percent copper. The samples in the form of narrow capillaries were held in known temperature gradient of thermotransport apparatus until the stationary state was reached. The samples were analyzed for the concentration of copper along the length. Copper was observed to migrate to the colder regions in all the samples. The heat of transport, Q*, was determined for each composition from a plot of concentration of copper versus reciprocal absolute temperature. The value of Q* is the highest at trace amounts of copper (4850 cal/gm-atom), but decreases with increasing concentration of copper and levels off to 2550 cal/gm-atom at about 25 weight percent copper. The results are explained on the basis of electron-solute interaction and a gas model of diffusion. Author

N73-31031# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
THE RATE-CONTROLLED METHOD OF CONSTRAINED EQUILIBRIUM APPLIED TO CHEMICALLY REACTIVE OPEN SYSTEMS
Serge Galant and John P. Appleton Jul. 1973 59 p refs
(Grant NSF GP-32522X)
(FML-Publ-73-6) Avail: NTIS HC $5.00

A general thermodynamic and mathematical formalism is developed for treating multiphase nonequilibrium systems that may be described in terms of the constrained (or partial) equilibrium approximation. It is shown that such systems are completely described in terms of two of the usual thermodynamic variables, such as the pressure and temperature, the electrochemical potentials of the elements in the system, and additional intensive state variables that are related to particular constraints imposed on the system by the rate limiting reactions which control its nonequilibrium chemical composition. By recasting the equations of bulk fluid motion so that dependent variables are no longer the species concentrations, but rather a generally more limited number of extensive variables, a method is developed for treating open thermodynamic systems in the constrained equilibrium approximation. The interelationships between the so-called steady-state approximation, the linear phenomenological relationships of irreversible thermodynamics, and the method of constrained equilibrium are explored. Author

N73-31032# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
A KINETIC MODEL FOR THE FORMATION OF NITRIC OXIDE FROM ORGANIC FUEL NITROGEN
Richard Flagan, Serge Galant, and John P. Appleton Jul. 1973 37 p refs
(FML-Publ-73-7) Avail: NTIS HC $4.00

Kinetic models which describe the formation of nitric oxide from organic fuel nitrogen by combustion have been developed. Predictions of model calculations for the combustion of hydrocarbon fuels, which contain organic nitrogen in forms typical of those to be found in naturally occurring fossil fuels, appear to be in good agreement with the nitric oxide yields measured in premixed flame experiments. Author

N73-31033# Technische Hogeschool, Delft (Netherlands).
RCo5 AND RELATED SYSTEMS Ph.D. Thesis
Franciscus Antonius Kuijpers 20 Jun. 1973 113 p refs
Avail: NTIS HC $7.75

The reaction of hydrogen with intermetallic compounds of the RCo5 type (R is a rare earth atom) are examined. Some related systems, particularly those based on LaNi5 were included. Data cover structural, thermodynamic, and magnetization phemomena. The high desorption rate of hydrogen at ambient temperature is also analyzed. Author

N73-31034*# California Univ., Santa Cruz. Div. of Natural Sciences.
STABILITIES OF NITROGEN CONTAINING HETEROCYCLIC RADICALS AND GEOMETRICAL INFLUENCES ON NON-RADIATIVE PROCESSES IN ORGANIC MOLECULES Final Report, Sep. 1971 - Jun. 1972
Earl M. Evleth Jun. 1972 72 p refs
(Grant NGL-05-061-004)
(NASA-CR-133919) Avail: NTIS HC $5.75 CSCL 07D

Stabilities of nitrogen containing heterocyclic radicals were studied to detect radicals of the type R-N-R, and to theoretically rationalize their electronic structure. The computation of simple potential energy surfaces for ground and excited states is discussed along with the photophysical properties of indolizine. Methods of calculation and problems associated with the calculations are presented. Results, tables, diagrams, discussions, and references are included. K.M.M.

N73-31035*# Scientific Translation Service, Santa Barbara, Calif.
INTERACTION OF TITANIUM NITRIDES WITH OXYGEN AND CARBON DIOXIDE
Yu. G. Gurevich, Yu. K. Semenov, and V. I. Yeliseyev Washington NASA 21 Sep. 1973 7 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 4, Apr. 1969 p 10-12
(Contract NASw-2483)
(NASA-TT-F-15108) Avail: NTIS HC $3.00 CSCL 07D

Results are given of studies of the kinetics of the oxidation of synthetic titanium nitride in a current of oxygen or carbon dioxide. Rutile and nitrous oxide are obtained. The values of the rate constants indicate that the oxidation process takes place in a large temperature range. Author

N73-31036# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
LOW TEMPERATURE THERMAL MAGNETORESISTANCE OF POTASSIUM
R. S. Newrock and B. W. Maxfield Jan. 1973 16 p refs

(Contract At(11-1)-3150; Grant NSF GH-33637)
(COO-3150-12; Rept-1935) Avail: NTIS HC $3.00

Unexpected magnetic field behavior was observed in the low temperature thermal magnetoresistance of potassium. The thermal resistance does not saturate nor does it mirror the electrical magnetoresistivity. At high fields, a field dependent Wiedmann-Franz ratio was observed. Author (NSA)

N73-31037# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
CONCENTRATION DETERMINATION OF IMPREGNATION SALT SOLUTIONS FOR TELECOMMUNICATION MASTS USING RADIATION PHYSICS METHODS [BESTIMMUNG DER KONZENTRATION VON TRAENKSALZLOESUNGEN FUER FERNMELDEMASTEN NACH METHODEN DER STRAHLUNGSPHYSIK]
G. Lemm Nov. 1971 14 p In GERMAN
(FTZ-A-518-TBR-1) Avail: NTIS HC $3.00

A method for rapid determination of impregnating solution concentration for wooden telecommunication masts, based on X ray fluorescence is described. The protection of wood by impregnation with the elements As, Cu, Cr, F, and B was investigated. In order to obtain a picture of the evenness of the impregnation, the solution concentration over each element of the corresponding type of salt was determined. ESRO

N73-31038# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
SYNTHESIS AND ANALYSIS OF POLY(VINYL-CO-VINYLENE) NITRATES [DARSTELLUNG UND UNTERSUCHUNG VON POLY(VINYL-CO-VINYLEN)NITRATEN]
K. M. Bucerius 18 Sep. 1972 33 p refs In GERMAN
(ICT-7/72) Avail: NTIS HC $3.75

The synthesis and analysis of poly(vinyl-CO-vinylene)nitrates with 7 to 70 mol % vinylene nitrate constituents are discussed. It is shown that polymeric nitric acid esters can be obtained by copolymerization of vinyl nitrate and vinylene nitrate with a comonomer content of between 8 and 20 mol % vinylene nitrate, without loss of stability compared to polyvinylene nitrate. ESRO

N73-31039# Michigan State Univ., East Lansing. Dept. of Chemistry.
THE VIBRATIONAL SPECTRA OF SOLID FLUORINE
T. M. Niemczyk, R. R. Getty, and G. E. Leroi Jul. 1973 23 p refs
(Contract N00014-68-A-0109-009; NR Proj. 014-503)
(AD-763686; TR-11) Avail: NTIS CSCL 07/4

Raman and far infrared spectra of crystalline fluorine have been obtained in both solid phases. As expected for the disordered higher temperature form, only the Raman-active stretching fundamental is observed for beta-F2. The predictions of a preliminary calculation of the optically active lattice frequencies for the low temperature phase are in poor agreement with the observed lattice frequencies, suggesting that an improved model will be required to help distinguish the correct alpha-F2 crystal structure. Solid fluorine more closely resembles oxygen than it does the other halogens. In particular, the intermolecular forces are extremely weak, as exemplified by the small shifts of the internal frequencies from their gas phase values, the absence of observable factor group splitting of the fundamental and the overtone, and the relatively low values of the external (lattice) frequencies. (Modified author abstract) GRA

N73-31040# United Aircraft Corp., East Hartford, Conn.
HYDRAZINE IMPURITY SURVEY
G. L. M. Christopher and C. T. Brown Jun. 1973 62 p
(Contract F04611-73-C-0019)
(AD-764365; AFRPL-TR-73-24) Avail: NTIS CSCL 07/3

A study of the amounts of specific contaminants present in propellant grade (Mil Spec) hydrazine obtained from a number of users has been carried out. A total of twenty-four samples from twelve user groups was analyzed. The contaminants examined included particulate materials, organic impurities, water, carbon dioxide, metals and chloride. The level of particulate contamination, the particle size distribution and approximate identification of chemical types were established by appropriate techniques. Major metal contaminants were determined by atomic absorption and trace metal contaminants were determined by emission spectroscopy. Other contaminants were assayed by gas chromatographic, ultraviolet spectroscopic or colorimetric techniques. Author (GRA)

N73-31041# Miami Univ., Coral Gables, Fla. Dept. of Chemistry.
MECHANISMS OF REACTIONS OF OXIDIZERS Annual Report, 1 Jun. 1972 - 31 May 1973
A. G. Keenan 31 May 1973 9 p
(Contract N00014-67-A-0201-0014)
(AD-762744; AR-12) Avail: NTIS CSCL 07/4

Progress during the year in the investigations of the mechanism of decomposition of oxidizers such as ammonium nitrate and ammonium perchlorate is summarized. Areas of investigation include the study of the electrical conductivity of single crystals of ammonium perchlorate, measurement of mobility ratios, ion exchange constants and selectivity ratios of cations in Pyrex immersed in fused nitrates and the study of the electrode reactions at both Cu/CuO and Pt/PtO2 electrodes in carbonate containing fused nitrates exposed to atmospheres of O2, CO2, N2 and H2O. Publications issued and pending are listed.
Author (GRA)

N73-31042# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Advance Aerothermodynamics and Nuclear Effects.
ESTIMATION OF GAS-PHASE THERMOKINETIC PARAMETERS. VOLUME 1: A FORTRAN PROGRAM FOR COMPUTING THE THERMOCHEMICAL PROPERTIES OF COMPLEX GAS MOLECULES BY THE METHOD OF GROUP ADDITIVITY. BOOK 2: APPENDIXES
Maria Ramos Martinez Apr. 1973 217 p refs
(Contract DAAB05-72-C-0098)
(AD-762614; MDC-G4388; BRL-CR-107) Avail: NTIS CSCL 07/4

A FORTRAN program for calculating the thermodynamic properties of complex gas molecules by the method of group additivity is documented herein. Included are descriptions of the computational method, characteristics, functions, input/output formats, and logic structure of the program. Seventeen case calculations for diversely structured molecules are presented. Also depicted are a listing of the program, a complete glossary of the program variables and the tables of data comprising the data library input. Author (GRA)

N73-31043# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
SPECTROPHOTOMETRIC TECHNIQUES FOR THE STUDY OF ELECTRODE PROCESSES Final Report, Apr. 1971 - Nov. 1972
T. Kuwana Mar. 1973 41 p refs
(Contract DAAB07-68-C-0278; DA Proj. 1T0-61102-A-34A)
(AD-763265; ECOM-0278-F-68) Avail: NTIS CSCL 07/4

The report includes a discussion on the types of electrochemical mechanisms which can be studied and evaluated by spectroelectrochemical methods using optically transparent electrodes (OTE); description on the preparation and properties of a new kind of optical electrode, the transparent mercury-platinum OTE; and a discussion on the spectroelectrochemical study of metal deposition and stripping, and of specific adsorption on the Hg-Pt OTE. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-31044 British Broadcasting Corp., Kingswood (England). Research Dept.
MF NETWORK PLANNING: THE COVERAGE UNDER DAYTIME CONDITIONS FROM A NETWORK OF TRANSMITTERS ARRANGED IN A UNIFORM LATTICE
R. A. Rowden Jul. 1973 22 p refs

(BBC-RD-1973/11; RA-110) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Definitions of the various types of network where transmitters are arranged geographically over an area and a given number of frequency channels is available for use are reported. The method of calculation of the coverage is described and useful formulae are stated. An exemplary tabulation for limited ranges of power, frequency, ground conductivity and distance, is attached. Author

N73-31045 Ohio Univ., Athens.
COMPUTER SOLUTIONS OF CYLINDRICAL ANTENNAS IN ANISOTROPIC MEDIA Ph.D. Thesis
Chiu Hsiung Cheng 1972 200 p
Avail: Univ. Microfilms Order No. 73-12624

The near- and far-field solutions of a cylindrical antenna embedded in an isotropic, a uniaxial and a magnetoionic media are considered. A numerical method combined with the appropriate dyadic Green's function in the computation of the input admittance and impedance, the current distribution, and the far-field power gain pattern of a cylindrical antenna is presented. In the case of an isotropic medium, the results obtained agree with those by other methods. A closed form dyadic Green's function for an uniaxial medium was derived. For a magnetoionic medium, an asymptotic dyadic Green's function was used for far-field computations. Dissert. Abstr.

N73-31046 Illinois Inst. of Tech., Chicago.
SCATTERING OF ELECTROMAGNETIC WAVES FROM PLANAR AND ROUGH OSCILLATING SURFACES Ph.D. Thesis
Suresh Ramchandra Borkar 1972 161 p
Avail: Univ. Microfilms Order No. 73-12200

The problem of scattering from moving planar surfaces is reformulated into an equivalent one which requires the solution of the inhomogeneous equation with radiation conditions at infinity. This is done with the help of the induction theorem. The moving surface is replaced by equivalent electric and magnetic sources with spatial movements associated with these. The motion of the surface is characterized both as a deterministic function as well as stationary and non-stationary processes. For statistical motion of the surface, the mean, the variance, and frequency distribution in the received signal are studied. For the case of a rough oscillating surface, the spectral fourier method is employed and the unknown coefficients are determined using perturbation analysis. The surface is characterized in terms of its surface impedance and both cases of polarization are treated. The results can be directly applied to the study of scattering from sea surface. Dissert. Abstr.

N73-31047 Oklahoma State Univ., Stillwater.
OPTIMUM ARRAY PROCESSING FOR DETECTING BINARY SIGNALS CORRUPTED BY DIRECTIONAL INTERFERENCE Ph.D. Thesis
Chen-Shu Chiu 1972 132 p
Avail: Univ. Microfilms Order No. 73-11473

Optimum systems for detecting corrupted binary signals received by a linear antenna array of equally spaced isotropic point elements are considered. The binary signals may either be completely known or have a random amplitude, which is Rayleigh distributed, and a random phase uniformly distributed. The additive noise has two components. The interfering signal is modeled as a wide-sense stationary Gaussian process. The internal noise, which is generated by the processing unit behind each antenna, is assumed to be a white noise. It is found that the optimum processors are basically correlation receivers. In general, the structures of processors are dependent on the power spectrum of the interfering signal. Dissert. Abstr.

N73-31048 British Broadcasting Corp., Kingswood (England). Engineering Div.
DIGITAL METHODS FOR THE TIMING CORRECTION OF TELEVISION SIGNALS
J. R. Chew Aug. 1973 8 p refs
(BBC-RD-1973/15; PH-107) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Alternatives to the conventional analogue methods of television signal timing-correction are outlined in which the signal is stored and time-shifted in digital form. In such an alternative system, the timing information is carried by clock signals, and methods of deriving these clock signals both for writing into, and reading from the stores are discussed. An experimental digital timing corrector for a video tape machine, controlled by a pilot-tone added to the input signal, was built and its performance is described; this might be summarised as effecting the complete removal of timing errors at the cost of introducing some chrominance noise. Future developments envisaged in which the digital storage may be organized to provide drop-out compensation. In addition, the possibility of using digital timing correction in a television-signal synchronizer is outlined. Author

N73-31049 British Broadcasting Corp., Kingswood (England). Research Dept.
INTERFERENCE DUE TO DATA TRANSMITTED AFTER THE TELEVISION FIELD SYNCHRONISING SIGNAL
G. M. LeCouteur Aug. 1973 8 p refs
(BBC-RD-1973/12; PH-106) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The interference caused by data transmitted during the period immediately following the broad pulse sequence of the television field synchronizing waveform is studied. It is known that data signals transmitted at this time will appear on field flyback lines and can sometimes cause interference. Suggested is a way of transmitting the data without causing interference, but it is concluded that a preferable long term solution would be to modify the field synchronizing waveform in such a way as to provide extra line periods during which to transmit the data. Author

N73-31050 British Broadcasting Corp., Kingswood (England). Research Dept.
MEDIUM FREQUENCY PROPAGATION: NON-RECIPROCAL IONOSPHERIC PROPAGATION ON MULTI-HOP PATHS
P. Knight Aug. 1973 4 p refs
(BBC-RD-1973/17) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

At medium frequencies, polarization coupling loss occurs on multi-hop paths when waves relected from the earth's surface reenter the ionosphere. Under some circumstances the coupling loss changes significantly when the direction of propagation is reversed. Author

N73-31051 British Broadcasting Corp., Kingswood (England). Research Dept.
MEDIUM FREQUENCY PROPAGATION: A WAVE-HOP METHOD FOR IONOSPHERIC FIELD-STRENGTH PREDICTION
P. Knight Aug. 1973 17 p refs
(BBC-RD-1973/13; RA-113) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A new method for calculating the strength of medium-frequency sky-wave signals at night is described. Estimated losses due to all the ionospheric and terrestrial factors which affect a wave as it propagates from transmitter to receiver are subtracted from the field strength which would arise if losses were absent. This process is carried out for each propagation mode which is likely to make a significant contribution to the received signal; the contributions are then added on a power basis. The method is intended for world-wide application and for paths of any length. Field strengths predicted by this method for 152 paths in different parts of the world have been found to agree reasonably well with measured values. Author

N73-31052 Kansas Univ., Kansas City.
THE RELATIVE EFFECTS OF SYSTEM AND SURFACE PARAMETERS ON RETURN SIGNAL FADING Ph.D. Thesis
Arye Zachs 1972 141 p
Avail: Univ. Microfilms Order No. 73-11971

The fading spectra of backscattered signals have been commonly associated only with the relative motion (Doppler) effects with no reference to the scattering characteristics of the surfaces involved. A theory is developed which relates the fading spectra to both Doppler and surface effects. The physical optics method is used to describe the scattering characteristics of the surface for both rough and small perturbation models. It is shown that fading spectra become insensitive to surface statistical

parameters at very small values of rms surface slopes and sizes of the illuminated areas. The analysis also shows that in the absence of the Doppler component the fading is determined by the size of the resolution cell. Dissert. Abstr.

N73-31053 New York Univ., N.Y.
A CURVATURE-CORRECTED KIRCHHOFF FORMULATION FOR RADAR SEA-RETURN FROM THE NEAR VERTICAL Ph.D. Thesis
Frederick Carl Jackson 1972 77 p
Avail: Univ. Microfilms Order No. 73-9095

A theoretical treatment of the problem of electromagnetic wave scattering from a randomly rough surface is given. A high frequency correction to the Kirchhoff approximation is derived from a field integral equation for a perfectly conducting surface. The corrected current density is substituted into the far field Stratton-Chu integral, and average backscattered powers for the four linear polarization combinations are computed on the assumption that the scattering surface is describable as a homogeneous Gaussian random process. The strength of the solution is that local diffraction effects arising from surface curvature are properly correlated with surface height and slope without requiring their smallness. Application to radar backscatter and natural microwave emission from the sea is discussed. It is concluded that this corrected Kirchhoff formulation offers a superior predictive capacity for co-polarized and depolarized returns from the near vertical. Dissert. Abstr.

N73-31054# Joint Publications Research Service, Arlington, Va.
RADAR THEORY AND PRACTICE
A. G. Saybel, ed. 1 Jun. 1973 298 p refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiocokatsii" Moscow, Machine Building Press 268 p
(JPRS-56143) Avail: NTIS HC $17.00

Methods for improving the primary and secondary processing systems for radar imagery interpretation are presented. The subjects discussed are: (1) processing binary quantized signals, (2) statistical analysis of radar meters, (3) statistical analysis of interperiod compensation systems, and (4) problems of radar signal detection. For individual titles, see N73-31055 through N73-31082.

N73-31055 Joint Publications Research Service, Arlington, Va.
TIME-AMPLITUDE QUANTIZATION OF PULSED RADAR SIGNALS
V. A. Likharev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 3-8 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 4-9 (For availability see N73-31054 22-07)

Time amplitude quantization of pulsed radar signals is discussed. A device is proposed which is free of the deficiencies of ordinary quantizers. The two deficiencies which are corrected by the device are: (1) low range finding accuracy with respect to a packet of binary quantized signals and (2) low noiseproofness. Relations are presented for calculating the probability that the noise and signal-plus-noise blips will exceed the amplitude quantization threshold. Author

N73-31056 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF THE MEAN TIME BETWEEN SUCCESSIVE FALSE DETECTIONS FOR A BINARY SIGNAL DETECTOR WITH VARIABLE MEMORY SIZE
Ya. A. Furman and V. A. Kikharev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 9-15 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 9-15 (For availability see N73-31054 22-07)

A study was made of the problems connected with determining the average number of false targets (the average time between successive false detections) in the scanning sector for uncorrelated noise in detectors with an unknown time of arrival of the target signal. Nonclassical criteria are used for finding a solution. The average time between successive false detections is obtained as a function of the quantization threshold. Author

N73-31057 Joint Publications Research Service, Arlington, Va.
MEASURING THE ANGULAR POSITION OF A TARGET BY SCANNING RADAR AGAINST A BACKGROUND OF CORRELATED NOISE
Yu. A. Nifontov and V. A. Likharev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 16-23 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 15-22 (For availability see N73-31054 22-07)

The problems of estimating the target azimuth against a background of correlated noise are solved. The potential accuracy of angle gaging is determined. A study is made of the quasi-optimal algorithm for measuring the angular position of the target. Author

N73-31058 Joint Publications Research Service, Arlington, Va.
ESTIMATING THE DIRECTION FINDING ACCURACY OF A SCANNING RADAR USING THE MARKOV CHAIN APPARATUS
V. A. Likharev, Ya. A. Furman, and A. S. Kartashkin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 24-29 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 23-28 (For availability see N73-31054 22-07)

A method of calculating the estimate dispersion of the azimuth measured by a scanning radar is discussed. The aximuth is estimated by the maximum output voltage of the binary integrator. Discrete Markov chains are used to estimate the accuracy of direction finding. It is demonstrated that the transition probability matrix for the Markov chain in the given case will be a Jacobian matrix. Expressions are derived for calculating the matrix elements. Author

N73-31059 Joint Publications Research Service, Arlington, Va.
ORTHOGONAL BINARY RANDOM PROCESSES
G. G. Dzhavadov *In its* Radar Practice and Theory (JPRS-56143) 1 Jun. 1973 p 30-34 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 28-33 (For availability see N73-31054 22-07)

A procedure is presented for connected but orthogonal binary random processes with continuous time. The orthogonality is demonstrated and a simple smooth transition from the discrete distribution to exponential distribution of the time intervals is presented. Formulas are given for calculating the power in the given frequency band for discrete and continuous processes Author

N73-31060 Joint Publications Research Service, Arlington, Va.
SPECTRAL-CORRELATION CHARACTERISTICS OF A PAIR OF ORTHOGONAL BINARY RANDOM SIGNALS
I. A. Sklyarov and G. G. Dzhavadov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 35-41 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiocokatsii" Moscow, Machine Building Press p 33-39 (For availability see N73-31054 22-07)

A study was made of the probability characteristics of two dependent binary random processes orthogonal to each other. Formulas are obtained which permit determination of the values of the transition probabilities of one process in terms of the known transition probabilities of another process. Expressions are presented for calculating the spectral correlation characteristics of the processes. Author

N73-31061 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF THE OPERATION OF PULSE RADAR AUTOMATIC RANGE FINDERS
A. Ye. Kharybin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 42-56 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 40-53 (For availability see N73-31054 22-07)

A study was made of the block diagram of an automatic radar range finder jointly with a search and lock-on system. The structural diagram is presented for the automatic lock-on device and it is demonstrated that the automatic lock-on device is analogous with respect to its operating principles to a binary-quantized signal integration circuit which establishes the fact of the presence of a target on arrival of a fixed number of responses in a row. The basic arguments with respect to selecting the search velocity of the target are discussed. An example of analysis

of the operation of the pulse automatic range finder is given.
Author

N73-31062 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF TRACKING SYSTEMS WHICH MAINTAIN CONSTANCY OF THE PRODUCT (OR QUOTIENT) OF DEPENDENT AND INDEPENDENT VARIABLES
R. A. Gonchar and A. G. Saybel *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 57-65 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 53-62 (For availability see N73-31054 22-07)

A study was made of the dynamic properties and statistical characteristics of a class of tracking measuring systems which keep the product (or quotient) of the dependent and independent variables constant. The use of automatic regulators to produce the type of tracking desired is discussed. Block diagrams of the circuits are provided. Mathematical models are developed to show the relationships of the various parameters. Author

N73-31063 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF PHASE RADIO RANGE FINDERS WITH MUTUAL AUTOMATIC SCALING FREQUENCY CONTROL IN THE INTERROGATION-RESPONDER
R. A. Gonchar and A. G. Saybel *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 66-73 ref Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 62-70 (For availability see N73-31054 22-07)

The differential equations of phase radio range finders with mutual automatic scaling frequency control in the interrogator and responder were found. The stability conditions of the range finder were determined considering the presence of the receiver of a filter for tracking the scaling frequency of the channel. The expressions were found for the dynamic errors in measuring the range and rhw noise bands of the interrogator and responder.
Author

N73-31064 Joint Publications Research Service, Arlington, Va.
STATISTICAL ERROR ANALYSIS OF AM RADIO ALTIMETERS WITH PHASE READOUT
V. V. Tsvetnov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 71-96 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 71-96 (For availability see N73-31054 22-07)

A study was made of the effect of the extent of the earth's surface on the statistical structure of the signals of a phase radial altimeter with amplitude modulation and a coherent detector. The altitude readings were analyzed. It was demonstrated that under certain conditions, the phase information about the measured altitude can be suppressed. Author

N73-31065 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE TYPE OF DETECTION ON THE STATISTICAL PROPERTIES OF THE SIGNAL IN AN AM RADIO ALTIMETER WITH PHASE READOUT
V. V. Tsvetnov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 100-124 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 96-120 (For availability see N73-31054 22-07)

The effect of the type of detection on the statistical properties of the signal in amplitude modulation radio altimeters with phase readout was investigated. It was demonstrated that the application of a quadratic or synchronous detector instead of a coherent detector improves the phase and amplitude statistical characteristics of the signal. The synchronous detector is unable to eliminate the effect of suppression of the phase and range finding information. Author

N73-31066 Joint Publications Research Service, Arlington, Va.
STATISTICAL ERROR ANALYSIS OF AN FM RADIO ALTIMETER WITH PHASE READOUT
Yu. L. Pivovarov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 125-139 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 125-139 (For availability see N73-31054 22-07)

A statistical error analysis of a frequency modulated radio altimeter with phase readout was conducted. A study was made of the representation of the range finder power distribution of an echo from an extended surface in the signal parameters of the altimeter during signal processing. Systematic and fluctuation range measurement errors were determined. Author

N73-31067 Joint Publications Research Service, Arlington, Va.
ANALYSIS OF THE EFFICIENCY OF SYSTEMS FOR SELECTING MOVING TARGETS WHEN USING INTERPERIOD COMPENSATION DEVICES
P. A. Bakulev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 140-144 Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 134-138 (For availability see N73-31054 22-07)

An analysis of the efficiency of systems for selecting moving targets when using interperiod compensation devices was conducted. Structural models of the moving target selection systems convenient for analysis were constructed. Statistical properties of the signals and noise were proposed and justified.
Author

N73-31068 Joint Publications Research Service, Arlington, Va.
JOINT PROBABILITY DISTRIBUTION DENSITY OF THE AMPLITUDE DIFFERENCE AND PHASE DIFFERENCE OF THE SUM OF THE SIGNAL AND CORRELATED NOISE IN INTERPERIOD SUBTRACTION CIRCUITS
P. A. Bakulev and M. B. Tenin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 145-157 refs Transl. into ENGLISH of the book "Teoriya i Teknhika Radiolokatsii" Moscow, Machine Building Press p 138-148 (For availability see N73-31054 22-07)

The joint probability density of the amplitude difference and phase difference of the sum of the signal and correlated noise was found for the interperiod compensation systems of moving target selection systems. The selected model corresponds to using the pulse method with external coherence and the excess of the intensity of the external correlated noise over the level of the natural noise of the receiver. Mathematical models are developed to define the relationships of the parameters. Author

N73-31069 Joint Publications Research Service, Arlington, Va.
PROBABILITY DISTRIBUTION DENSITY OF THE PHASE DIFFERENCE OF THE SUM OF SIGNAL AND CORRELATED NOISE
P. A. Bakulev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 158-165 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 149-156 (For availability see N73-31054 22-07)

The joint probability density of the amplitude difference and phase difference of the sum of the signal and correlated noise was found for the interperiod compensation systems of moving target selection systems. Mathematical models are developed to show the relationships of the parameters. It is determined that the probability density of the output variable of the system will coincide with accuracy to a constant coefficient with the probability distribution of the cosine of the phase difference.
Author

N73-31070 Joint Publications Research Service, Arlington, Va.
PROBABILITY DISTRIBUTION DENSITY OF THE AMPLITUDE DIFFERENCE OF THE SUM OF THE TARGET SIGNAL AND CORRELATED NOISE
P. A. Bakulev and M. B. Tenin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 166-172 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 156-162 (For availability see N73-31054 22-07)

An expression was found for the probability distribution density of the phase difference of the sum of the signal and noise and noise only which is required for estimating the efficiency of phase interperiod compensation systems. Mathematical models are developed to show the relationships of the significant parameters. Author

N73-31071 Joint Publications Research Service, Arlington, Va.
PROBLEM OF ANALYZING THE DISTRIBUTION DENSITY OF A PROCESS AT THE OUTPUT OF AN IPC SYSTEM
M. B. Tenin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 173-177 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 162-166 (For availability see N73-31054 22-07)

The problem of analyzing the distribution density of a process at the output of an IPC system is discussed. The expediency of using the model of a signal in the form of a normal narrow-band process when estimating the statistical characteristics of the signal at the output of an interperiod compensation system was demonstrated. Expressions were obtained for the point distribution densities of the phase and amplitude differences of the signal suitable for engineering estimates. An expression was derived for the amplitude difference distribution moments. Author

N73-31072 Joint Publications Research Service, Arlington, Va.
SPEED CHARACTERISTICS OF IPC SYSTEMS WITH INTERMITTENT PULSE REPETITION PERIODS
Yu. A. Korablev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 178-182 ref Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 167-171 (For availability see N73-31054 22-07)

A study was made of the problems of formation of speed characteristics in interperiod compensation systems when using intermittent pulse repetition periods. It was demonstrated that the resultant speed characteristic is formed by the speed characteristics of the possible different groups of pulses insuring operation of the compensation system. Author

N73-31073 Joint Publications Research Service, Arlington, Va.
DETECTION OF A QUASIDETERMINISTIC SIGNAL WITH SIMULTANEOUS MEASUREMENT OF ITS PARAMETERS
V. G. Valeyev and Yu. G. Sosulin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 183-203 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 172-189 (For availability see N73-31054 22-07)

A study was made of the problems of synthesis and analysis of optimal systems for the separation of quasideterminant signals from noise. The general expressions defining the structure and characteristics of the receiver which is optimal in the Gaussian approximation were obtained. The functional schematics of the harmonic signal receiver for an unknown amplitude, initial phase, and frequency were found. The detection characteristics of the harmonic signal and the phase and frequency measurement characteristics were investigated. Author

N73-31074 Joint Publications Research Service, Arlington, Va.
EFFECT OF A PRIORI INFORMATION ON THE LOCATION OF AN OBJECT ON THE QUALITY OF RADAR DETECTION
B. A. Voynich, G. A. Volkova, and M. V. Andreychuk *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 204-211 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 190-197 (For availability see N73-31054 22-07)

A study was made of the possibility of using prior information about the location of objects in the given ranges for calculating the radar energy potential. Relations are presented for the probability of making a correct decision as a function of the magnitude of the probabilities of correct decision and false alarm. The possibility of reduction of the required transmitter power for normal distribution density of the range to the target is demonstrated. Author

N73-31075 Joint Publications Research Service, Arlington, Va.
DETECTION OF WEAK SIGNALS IN THE OPTICAL WAVE RANGE
S. N. Marova *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 212-224 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 198-208 (For availability see N73-31054 22-07)

A study was made of a receiver which detects coherent and incoherent optical signals against a background of noise. The form of the optimal detection operator and the structure of the receiver realizing optimal signal reception against a background of noise in the optical wave range is presented. The detection characteristics of the receiver using the principle of photoelectronic recording of light are presented, and some characteristic features of the signal detection process in the optical wave range are noted. Author

N73-31076 Joint Publications Research Service, Arlington, Va.
MULTIFILTER DETECTION CIRCUIT USING A PHASE AUTOCORRELATOR
G. A. Volkova, A. I. Yuditskiy, and A. S. Pronin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 225-234 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 209-216 (For availability see N73-31054 22-07)

The operation of the phase autocorrelator in the case of noncoincidence of the frequency of the received signal and the filter tuning frequency is analyzed. The probability of correct detection was found as a function of the frequency difference of the signal and the central frequency of the matched filter on the basis of which the possibility of constructing a multifilter system with the application of a phase autocorrelator is demonstrated. Author

N73-31077 Joint Publications Research Service, Arlington, Va.
DETERMINATION OF THE RANGE TO A TARGET BY PASSIVE RADAR
O. V. Belavin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 235-243 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 216-223 (For availability see N73-31054 22-07)

Versions of the use of a passive radar to determine the range to a target emitting a radio signal are investigated. The requirements on the accuracy for measuring the geometric variables are formulated. Mathematical models are developed to show the geometric picture of radio signal propagation from the target to a passive radar. Author

N73-31078 Joint Publications Research Service, Arlington, Va.
SPECTRUM AND CORRELATION FUNCTION OF THE RANDOM PROCESS AT THE OUTPUT OF A KEY DETECTOR
A. A. Sosnovskiy *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 244-253 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 224-231 (For availability see N73-31054 22-07)

The energy spectrum and autocorrelation function of the random process at the output of a key detector were determined as applied to correlometers with an electronic signal delay. It was demonstrated that in the case of efficient selection of the parameters of the key detector, the distortions of the autocorrelation function can be reduced to a small magnitude. Author

N73-31079 Joint Publications Research Service, Arlington, Va.
PERIOD MODULATION
N. V. Chetyrkin *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 254-261 Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 232-239 (For availability see N73-31054 22-07)

A study was made of the modulation of the high frequency oscillation period by symmetric and asymmetric signals. The problems of period modulation signal detection in noise were analyzed. It was demonstrated that for signals with a large peak factor and for asymmetric signals there is a definite gain when using period modulation. Author

N73-31080 Joint Publications Research Service, Arlington, Va.
STUDY OF SHORT-TERM INSTABILITY OF THE KLYSTRON FREQUENCY IN THE MILLIMETER RANGE
V. Ya. Plekin and N. P. Pospelova *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 262-266 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 239-244 (For availability see N73-31054 22-07)

A procedure is discussed and a schematic is presented for measuring the short-term instability of the millimeter band klystron frequency. Results are presented from an experimental measurement of the short-term frequency instability of the investigated klystrons in the time intervals of 0.1 to 16 milliseconds. Author

N73-31081 Joint Publications Research Service, Arlington, Va.
SAWTOOTH VOLTAGE GENERATOR WITH SHORT RETURN TIME c09
K. V. Barinov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 267-271 ref Transl. into ENGLISH of the

book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 244-248 (For availability see N73-31054 22-07)

A schematic is proposed for a sawtooth voltage generator using a blocking generator as the switch. This offers the possibility of obtaining a sawtooth voltage with a low return time determined by the blocking generator pulse duration. It can be used to improve the repetition period stability of the blocking generator. Author

N73-31082 Joint Publications Research Service, Arlington, Va.
THREE CENTIMETER RING BALANCED MODULATOR
c09

Yu. A. Ostroumov and A. M. Klementyev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 272-284 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 249-262 (For availability see N73-31054 22-07)

Theoretical and experimental studies were made of a ring balanced superhigh frequency modulator. The block diagram and experimental procedure are presented. Graphs were obtained for the carrier suppression in the balanced and ring balance modulator as a function of the amplitude and phase of the modulating voltages. Maximum suppression of the carrier in the balanced and ring modulators of 54 decibels and suppression of one of the spurious carriers in the ring balance modulator of 46 decibels were achieved. Author

N73-31083# Joint Publications Research Service, Arlington, Va.
ANOMALOUS NONLINEAR DISSIPATION OF HIGH-FREQUENCY RADIO WAVES IN PLASMA

V. P. Silin 24 Aug. 1973 52 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 108, no. 4, Dec. 1972 p 625-654
(JPRS-59883) Avail: NTIS HC $4.75

A discussion is presented of a group of nonlinear phenomena in plasma which is characteristic to have the onset of an anomalous high-frequency resistance produced by the resonance parametric effect of powerful radiation leading to the development of perturbations in plasma and to a turbulent state. Author

N73-31084*# North American Rockwell Corp., Downey, Calif.
AIRCRAFT-MOUNTED CRASH-ACTIVATED RADIO DEVICE Patent Application

Robert Manoli and Bertram R. Ulrich, inventors (to NASA) Filed 17 Nov. 1972 13 p Sponsored by NASA
(NASA-Case-MFS-16609-2; US-Patent-Appl-SN-307714) Avail: NTIS HC $3.00 CSCL 17B

A description is given of an aircraft crash location transmitter device. The device is mounted on the tail of an aircraft in a round sealed case held by a shear pin that releases under crash impact of 7 to 8 G's. The transmitter is powered by a batter which is kept charged by a trickel charge from the aircraft electrical system, preferably the wiring leading to the navigational light on the tail. The transmitter has a button actuated meter to test the transmitter battery condition while the apparatus is installed on an aircraft. At the time of the crash, the transmitter is released and ejected, the concave-formed metal spring blade antenna wound around the case unwinds and the transmitter starts emitting on emergency frequencies 121.5 MHz and 243 MHz. The transmitter, which is shock mounted within outer and inner cases, lands and continues transmitting for about 48 hours. NASA

N73-31085*# TRW Systems Group, Redondo Beach, Calif. Electronic Systems Engineering Dept.
ANTENNA AND PROPAGATION STUDIES FOR SPACECRAFT SYSTEMS: ADDENDUM TO PREFLIGHT SL-1/SL-3 SKYLAB VHF RANGING COVERAGE (EARLY AND LATE TPI)

D. R. Eisenhauer and D. A. James 25 Jul. 1973 55 p refs (Contract NAS9-12330)
(NASA-CR-133996; TRW-20029-H203-R0-01-Add) Avail: NTIS HC $4.75 CSCL 17B

A preflight assessment is presented of the expected Skylab VHF ranging coverage for the rendezvous portion of the SL-1/SL-3 mission, assuming a 28 July 1973 launch date, for the alternative trajectory cases characterized by either an early TPI or a late TPI. In this assessment early TPI and late TPI are used to indicate a TPI maneuver occurring 10 minutes prior to or after the nominally scheduled TPI maneuver, respectively. The Saturn workshop (SWS) maintains a solar inertial (SI) attitude throughout rendezvous for both trajectory cases. The results summarized concern VHF ranging function performance during that period most likely to be affected by off-nominal TPI conditions, i.e., NSR (5:56 g.e.t.) to station keeping. Curves are presented which show the variation in received power levels on both spacecraft-to-spacecraft links from about 100 n.mi. range to CSM and SWS station keeping. Appropriate threshold levels are shown on these received power curves to indicate zero circuit margins for the ranging function. Author

N73-31086# IIT Research Inst., Annapolis, Md.
AN EXTENDED AVIONICS INTERFERENCE PREDICTION MODEL Final Report

Leo C. Friske Jun. 1973 100 p refs
(Contract DOT-FA70WAI-175; F19628-73-C-0031; AF Proj. 649E)
(ECAC-PR-73-002; FAA-RD-73-9) Avail: NTIS HC $7.00

A previous ECAC modeling effort is extended. Options are provided to express the terms of the standard interference equation deterministically or probabilistically. A data base of most commonly found avionics equipments is established for automatic retrieval and application in the prediction model. Author

N73-31087# Rome Air Development Center, Griffiss AFB, N.Y.
RADAR MICROWAVE LINK (RML) ANTENNA PATTERN MEASUREMENTS Final Report

Roger G. Hunter Aug. 1973 191 p
(Contract DOT-FA71WAI-208)
(FAA-RD-73-118) Avail: NTIS HC $11.75

Results of the Radar Microwave Link (RML) antenna pattern measurements performed by Rome Air Development Center are reported. The data were taken with a C-131 aircraft equipped with a AN/FSM-17 antenna measuring system. The raw data from the measurements were converted to values of absolute gain and processed to form a series of polar plots which are presented in this report. Absolute gain is defined as the ratio of radiation intensity in a given direction to the radiation intensity produced by an isotropic radiator with the same input. Author

N73-31088*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ADAPTIVE TELEMETRY SYSTEMS Final Report, 1 May 1968 - 1 Feb. 1971

Paul A. Wintz 4 Oct. 1973 17 p refs
(Grant NGR-15-005-087)
(NASA-CR-130228; TR-EE-71-12) Avail: NTIS HC $3.00 CSCL 09F

Abstracts are presented of numerous research projects conducted over a 33 month period on adaptive telemetry systems. D.L.G.

N73-31089*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECORDER/PROCESSOR APPARATUS Patent Application

Ivan H. Shim, inventors (to NASA) and John J. Stelben Filed 7 Sep. 1971 55 p
(NASA-Case-GSC-11553-1; US-Patent-Appl-SN-177985) Avail: NTIS HC $4.75 CSCL 14C

An apparatus is reported for recording a data input on a thermally processible storage medium in which a light source, such as a modulated laser beam whose intensity is modulated in response to the incoming data input, is caused to generate a raster in conformance with incoming timing/control signals so as to expose a latent image of the input information on the storage medium. A rotating drum in conjunction with an incrementally driven lens carriage associated with the laser optical system provides the raster generation. The drum is automatically loaded with the storage medium and automatically unloaded to a thermal processor upon completion of recording. The latent image is processed by the controlled application of heat so as to produce an actual displayable image corresponding to the data input at the output of the apparatus. NASA

N73-31090# National Research Council of Canada, Ottawa (Ontario).

INVESTIGATION OF LOCAL REGIONS OF SOLAR RADIO RADIATION BY POLARIZATION OBSERVATIONS IN THE MICROWAVE BAND

D. V. Korolkov, N. S. Soboleva, and G. B. Gelfreikh 1973 69 p refs Transl. into ENGLISH from Izv. Gl. Astron. Observ. Pulkove (USSR), v. 21, no. 164, 1960 p 81-112
(NRC-TT-1681) Avail: NTIS HC $5.50

Observations of the polarization of radio radiation from local sources on the sun have been carried out in the microwave region. Methods of analyzing polarized radiation and the operating principles of certain specific polarization receiver schemes used in the observations are described. Difficulties encountered in investigating the nature of the polarization due to the large background of unpolarized radiation from the sun as a whole are also discussed. The observations were carried out with low resolution antennae during solar eclipses and with a radio-telescope. It was found that groups of sunspots are associated with regions of increased radio radiation in which the brightness temperature reaches several million degrees. Author

N73-31091*# National Aeronautics and Space Administration, Washington, D.C.

SOME REFLECTIONS CONCERNING MAGNETIC RESONANCE PHENOMENA IN THE DOMAIN OF RADIO FREQUENCIES

A. Kastler Sep. 1973 29 p refs Transl. into ENGLISH from Experientia, (Basel, v. 8/1, 1952 p 1-9 Presented at the Intern. Conf. on Spectry., Basel, 28-30 Jun. 1951
(NASA-TT-F-14733) Avail: NTIS HC $3.50 CSCL 17B

Several suggestions are advanced concerning the development and use of methods of radio-electric resonance. Initial attention is focused on the study of photomagnetic effects by magnetic resonance techniques. It is demonstrated that the existence of a spin-spin relaxation time allows an anticipation that paramagnetic crystals, submitted to a low temperature with magnetic resonance, become generators of hypersonic waves of definite frequency. It is also pointed out that by extending to mononcrystals, the investigation initiated with crystalline powders, the effects of anisotropy and coherence can be observed. D.L.G.

N73-31092*# California Univ., Los Angeles. Plasma Physics Group.

RELATIVISTIC PARTICLE MOTION IN NONUNIFORM ELECTROMAGNETIC WAVES

G. Schmidt and T. Wilcox Jun. 1973 14 p refs
(Grant NGL-05-007-190; Contract N00014-69-A-0200-4023) (NASA-CR-133888; PPG-152) Avail: NTIS HC $3.00 CSCL 20N

A charged particle moving in a strong nonuniform electromagnetic wave which suffers a net acceleration in the direction of the negative intensity gradient of the wave was investigated. Electrons will be expelled perpendicularly from narrow laser beams and various instabilities result. Author

N73-31093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DESIGNING HIGH-FREQUENCY DEVICES OF RADAR STATIONS

V. I. Vlasov and Ya. I. Berman 11 May 1973 520 p refs Transl. into ENGLISH from the monograph "Proeturovanie Vysokochastotnykh Ustroistv Radiolokatsionnykh Stantsii" Leningrad, 1972 p 1-368
(AD-764333; FTD-MT-24-1816-72) Avail: NTIS CSCL 17/9

Contents: Principles of design radar antenna equipment; Design of antennas in the form of a system of discrete sources; Beam scanning in radar antennas; Methods of building motionless antennas with circular space scanning; Design of end-fire arrays; Antennas with special radiation characteristics; Principles of designing high-frequency channels; Antenna design principles for shipboard radars; Elements of the high-frequency channels of shipboard radars; Control and measurement in high-frequency devices of marine radar. GRA

N73-31094# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).

SEARCH PROCEDURE FOR ELECTRONIC RADAR

Heiko Dannemann Sep. 1972 92 p refs In GERMAN; ENGLISH summary
(Rept-186) Avail: NTIS HC $6.75

Procedures for searching out targets by means of electronically steered phased array radar, providing a suitable search and taking into account the advantages of electronic radar are investigated. The basic requirement for any search routine is the existence of some a priori information about the possible location of targets. It can be shown that an antenna beam position with the highest echo signal is most likely to contain a target. Based on this, several search procedures are evaluated and compared both to each other and to a systematic search with respect to their efficiency and expenditure. ESRO

N73-31095# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

DIGITAL CORRELATION METHOD FOR SYNCHRONIZATION OF PSEUDORANDOM BINARY SEQUENCES IN BLOCKWISE TRANSMISSION OF NON-OVERLAPPING SUBSEQUENCES [EIN DIGITALES KORRELATIONSVERFAHREN ZUR SYNCHRONISATION PSEUDOZUFAELLIGER BINAERFOLGEN BEI BLOCKWEISER UEBERTRAGUNG NICHT UEBERLAPPENDER SUBSEQUENZEN]

G. Seifert Jun. 1972 30 p refs In GERMAN; ENGLISH summary
(FTZ-A-157-TBR-7) Avail: NTIS HC $3.50

A synchronization method is described for pseudorandom binary sequences in blockwise transmission of nonoverlapping subsequences, used in data transmission error detection bit-by-bit comparators. The control character used for synchronization may appear at any time in the subsequences. These characters are determined from the received data sequence by means of digital correlation. The bit samples of the control characters in the subsequences are not evaluated as a result of their irregular appearance. The synchronization takes place in two stages: (1) in frame of the synchronization of subsequences (with priority) and (2) in synchronization of the pseudorandom binary sequence. The receiver's synchronizing time was investigated as function of the length of the subsequence and the length of the control character bit samples. ESRO

N73-31096# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

PROPERTIES OF WAVEGUIDE COUPLING ELEMENTS [EIGENSCHAFTEN VON HOHLKABEL - VERBINDUNGSELEMENTEN]

A. Traeger and B. Fehn Oct. 1972 24 p refs In GERMAN
(FTZ-A-333-TBR-18) Avail: NTIS HC $3.25

A standard coupler for microwave waveguides was selected, and its effects on attenuation were investigated for waveguide connections with bending moments. The tensile stress tolerance was found to be 5000 kp for the coupler. For straight and curved waveguides, attenuation increases in the upper part of the transmission band developing from kinks in the connections. The bending angles for several curvature radii were measured, and the attenuation to be expected for different sectional curvatures was determined. For a waveguide section with a radius of 300 m, an additional attenuation of about 0.3 db/km would result at 50 GHz, and 0.7 db/km for 90 GHz. ESRO

N73-31097# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

DATA ERROR PROTECTION BY MEANS OF LINEAR SYSTEMATIC BINARY CODES: A SURVEY [DATENSICHERUNG MITTELS LINEARER, SYSTEMATISCHER BINAERCODES - EINE UEBERSICHTSSTUDIE]

R. Herzer Jan. 1972 102 p refs In GERMAN; ENGLISH summary
(FTZ-A-441-TBR-1) Avail: NTIS HC $7.25

A survey is presented of possibilities of data error protection in disturbed binary channels, restricted to linear systematic codes, and with an application to data transmission speeds of 50 Kbauds over telephone channels. The basics of coding, error detection, and correction are delt with, as well as code classifications and the relationship of systematic codes to abstract algebra. Error characteristics of data channels are discussed, and a series of mathematical channel models are considered. A variety of code error protection methods are examined in detail with regard to their use in binary channels within differing error structures:

random errors, burst errors, and mixed errors. Recommendations are given for provision of a number of channels for binary data transmission at 50 Kbauds, with a guaranteed quality (residual error rate). ESRO

N73-31098# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
ERROR RATE MEASURING EQUIPMENT OF A 640 Mbits/S PCM SIMULATOR
T. Adachi Jul. 1972 30 p refs
(FTZ-A-442-TBR-38) Avail: NTIS HC $3.50

The generation of 4 streams of 160 Mbits/s pseudorandom pulse test signals, and a digital word synchronization method for error rate measurements, as an experimental 640 Mbits/s PCM waveguide transmission system, are described. Four delayed versions derived from one 15 stage maximum length sequence with the aid of mod-2 additions serve as 4 different pseudorandom sources. A simple error rate counting circuit and a resettable counter using shift registers work together as a stabilizing circuit which controls the feeding of the clock to a reference pseudorandom pulse generator. Stability is further improved by an additional analog stabilizing circuit. Results show that by using these synchronization techniques a very stable, small, and versatile error rate measuring system can be obtained. ESRO

N73-31099# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
OBSERVATIONS OF A 210 km LONG 12 GHz LINK [BEOBACHTUNGEN AN EINER 210 km LANGEN 12-GHz-STRECKE]
N. Abel Jan. 1972 29 p refs In GERMAN; ENGLISH summary
(FTZ-A-455-TBR-34) Avail: NTIS HC $3.50

An experimental trans-horizon radio link of 210 km path length at 12 GHz was established in southwestern Germany, and the received signal was observed for 18 months. Cumulative probability distributions of the transmission loss relative to free space are presented. The behavior of the signal revealed different propagation mechanisms: tropospheric scatter propagation, reflection by layer-like structures, and attenuation and scattering by precipitation. The annual median value of field strength was considered in conjunction with existing propagation curves.
Author (ESRO)

N73-31100# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
SCATTERING CAUSED BY PRECIPITATION IN THE MILLIMETER WAVELENGTH RANGE. RESULTS OF CALCULATIONS
F. Dintelmann and F. Ruecker Jan. 1972 32 p refs In GERMAN; ENGLISH summary
(FTZ-A-455-TBR-35) Avail: NTIS HC $3.75

The differential scattering cross section of spherical particles with a complex refractivity was calculated according to Mie's theory, as a basis for estimating mm wave scattering caused by precipitation. The calculations were performed assuming Laws-Parsons and Marshall-Palmer drop distributions. Using measured drop distributions, it was demonstrated that the scattering cross section cannot be defined by rain rate and wavelength only. It was found that detailed knowledge of the droplet partition function is necessary because, even for equal rain rates, the scattering cross section may vary by a factor of two (for 3 cm wavelength). Therefore, the Marshall-Palmer distribution as well as the Laws-Parsons distribution function are useful only for order of magnitude estimates. This should be considered when calculating the interference between radio links. ESRO

N73-31101# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
DEPOLARIZATION MEASUREMENTS IN THE TELECASTING AND BROADCASTING REGION IV/V [DEPOLARISATIONSMESSUNGEN IM FERNSEHRUNDFUNKBEREICH IV–V]
L. Fehlhaber and H. Homuth Apr. 1972 20 p In GERMAN; ENGLISH summary
(FTZ-A-455-TBR-36) Avail: NTIS HC $3.00

Wave depolarization due to antennas and propagation was measured on two experimental paths for television broadcasting in the IV/V band. Multiple utilization of a particular frequency is necessary for optimal use of the spectrum. Decoupling is only effective when the depolarization due to antenna and propagation is small. On a strongly obstructed line-of-sight path, the polarization discrimination did not exceed 49 db in 99.9% of the time and 12 db in 1% of the time. Therefore, the decoupling may become nearly ineffective near the boundary of the coverage area of a broadcasting transmitter. The contributions of antennas and propagation to depolarization were investigated. ESRO

N73-31102# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
TEST SETUP OF A TV TRANSMISSION SYSTEM WITH VESTIGEAL SIDEBAND AMPLITUDE FREQUENCY MODULATION [VERSUCHSAUFBAU EINES TV-UEBERTRAGUNSSYSTEMS MIT RESTSEITENBANDAMPLITUDEN-FREQUENZMODULATION (RM/FM)]
B. Staudemeyer Jan. 1972 10 p refs In GERMAN
(FTZ-44-TBR-33) Avail: NTIS HC $3.00

An experimental television transmission setup, based on vestigeal sideband amplitude, frequency modulation is described. This modulation method was shown to be suitable for terrestrial TV broadcasting in the cm wavelength range. The laboratory setup includes modified commercial equipment. A short survey of the additional technical effort in using this modulation method is given. The operation and construction of the transmitters and receivers, and also the most important equipment and components used, are described. ESRO

N73-31103# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
PROPERTIES OF CODES FOR CODE-TRANSPARENT DIGITAL TRANSMISSION LINKS [EIGENSCHAFTEN VON CODES FUER CODE-TRANSPARENTE DIGITALE UEBERTRAGUNGSSTRECKEN]
J. Fahrendholz, H. W. Wellhausen, and D. Martin Oct. 1972 25 p refs In GERMAN; ENGLISH summary
(FTZ-44-TBR-35) Avail: NTIS HC $3.25

The design and operation mode of a high density bipolar LHDB encoder and decoder of grade 3 are described. The error propagation of HDB-encoded and scrambled signals caused by the decoding process was investigated. The influence of randomly distributed errors and bunched errors was considered. The increase of error rate in the case of randomly distributed errors is smaller for HDB-codes than for scrambled codes and amounts to about 20%. The power spectra of the described quasi-ternary line signals are given. Author (ESRO)

N73-31104# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
METHODS FOR RECOGNITION OF SPEECH SIGNALS IN MARINE COMMUNICATION [VERFAHREN ZUR ERKENNUNG VON SPRACHSIGNALEN IM SEEFUNKVERKEHR]
H.-J. Krause [1972] 13 p In GERMAN
(FTZ-416-TBR-5) Avail: NTIS HC $3.00

Speech recognition methods for disturbed ship radio communication systems are discussed. The transmission quality can be improved by speech-regulated volume control. The decision certainty and response time of such speech detectors are not very satisfactory. Therefore, a series of other methods was investigated. The testing took place with a test signal composed of several disturbed ship radio conversations. The best results were found for the method based on comparison of alternating peaks. Equipment utilizing this method is described. ESRO

N73-31105# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
DISPLAY OF DIAL NUMBERS, CALL TARIFF UNITS AND DATA BY LUMINESCENT DIODES FOR TOUCH-TONE TELEPHONE SETS [ANZEIGE VON WAEHLZIFFERN, GEBUEHRENEINHEITEN UND DATEN BEI FERNSPRECHTISCHAPPARATEN MIT TASTENWAHL DURCH LUMINESZENZ - DIODEN]
J.-H. Kirchner Jul. 1972 40 p refs In GERMAN; ENGLISH summary
(FTZ-421-TBR-4) Avail: NTIS HC $4.00

The possibilities of using luminescent diodes and nematic liquid crystals for display purposes in telephony were investigated.

An automatic auxiliary device for dialing is described. Optical display of a maximum of 16 digits of 4 bits, is controlled during the dialing procedure by a telephone set. In principle, it may also be designed for dial number repetition, for abbreviated dialing of numbers repeatedly required, and for storing and representation of data, in case of data interchange between telephone and computer. Apart from the nonmechanical display elements, the compatibility of complementing MOS and TTL logic for switching and storage purpose was studied. To economize on power and logic circuitry, a 64 bit random access memory in bipolar technique was used for sequential of the optical display system. ESRO

N73-31106# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
DETERMINATION OF THE ESSENTIAL PARAMETERS OF A SECOND ORDER DIGITAL SYSTEM [GESICHTSPUNKTE ZUR BESTIMMUNG DER WESENTLICHEN PARAMETER EINES DIGITALEN SYSTEMS ZWEITER ORDNUNG]
U. Assmus and W. Bartel Oct. 1972 11 p refs In GERMAN
(FTZ-442-TBR-40) Avail: NTIS HC $3.00

Four possibilities for the realization of a second order time division multiplex system are reviewed. Two systems for asynchronous operation with a bit rate of 8.448 Mbit/s, and two synchronous systems with bit rates of 8.448 Mbit/s, and 8.192 Mbit/s, are considered. The advantages and disadvantages of these methods with regard to their application in an integrated network are discussed. ESRO

N73-31107# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
PROVISIONAL ESTIMATION OF THE USABILITY OF 42 AND 85 GHz MILLIMETER WAVES IN TERRESTRIAL COMMUNICATIONS [DIE VORLAEUFIGE BEURTEILUNG DER EIGNUNG VON mm-WELLEN BEI 42 UND 85 GHz FUER TERRESTRISCHE NACHRICHTENVERBINDUNGEN]
J. Feldmann and K. Sakowski Mar. 1972 14 p refs In GERMAN
(FTZ-455-TBR-37) Avail: NTIS HC $3.00

The usability of 42 and 85 GHz mm waves for terrestrial television broadcasting was investigated. The probability of reception field strength as a function of place and time were estimated, and the expected transmission range for amplitude modulated TV broadcasting was determined. At 42 GHz and a 100 W transmitting power, broadcasting ranges of 8.2 km, 3.3 km, for 99% or 99.9% of the time can be obtained. For point-to-point communication the range may be 17 km or 6 km. At 85 GHz and a 20 W transmitting power the ranges are expected to be 3.4 or 1.5 km, and 8.3 or 3.1 km point-to-point. In the case of frequency modulation, these ranges would be more than double. ESRO

N73-31108# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
UTILIZATION OF ORTHOGONAL CARRIER MODULATION FOR TELEGRAPHY TRANSMISSION Interim Report [NUTZUNG ORTHOGONALER TRAEGERMODULATION ZUR TELEGRAFIEUEBERTRAGUNG (ZWISCHENBERICHT)]
A. Corbet Oct. 1972 29 p refs In GERMAN
(FTZ-455-TBR-39) Avail: NTIS HC $3.50

A noise tolerant radio telegraphy system is described, in which messages are transmitted by means of a carrier wave orthogonal to the carrier of an amplitude modulated long wave broadcasting transmitter. The circuit diagrams for the receiver and transmitter are presented. The dimensioning of the receiver circuit based on the phase lock loop principle is investigated. A laboratory set up is proposed, and possibilities for measurement of several system parameters are indicated.

N73-31109# AEG-Telefunken, Backnang (West Germany). Microwave Tube Dept.
COMPARATIVE STUDY OF TWT AND KLYSTRON FOR USE AS POWER AMPLIFIER IN TELEVISION BROADCAST SATELLITES. VOLUME 1: SUMMARY Final Report
D. Deml, K. H. Bluhm, and S. Lechler 12 Nov. 1972 112 p 2 Vol.
(Contract ESTEC-1512/71)
(ESRO-CR(P)-271) Avail: NTIS HC $7.75

An analytical design study for efficient traveling wave tubes and klystrons for use in a satellite television transmitter is described. The design is based on ppm-focusing in order to reduce the size and weight of the amplifiers, and multistage collectors are investigated to achieve efficiency. The comparison and selection of the most suitable amplifier is made, and the results of the analysis are given. ESRO

N73-31110# AEG-Telefunken, Backnang (West Germany). Microwave Tube Dept.
COMPARATIVE STUDY OF TWT AND KLYSTRON FOR USE AS POWER AMPLIFIER IN TELEVISION BROADCAST SATELLITES. VOLUME 2: TECHNICAL REPORT Final Report
Contract D. cnt ESTEC-1512/71 Deml, K. H. Bluhm, and S. Lechler 15 Nov. 1972 448 p refs 2 Vol.
(ESRO-CR(P)-272) Avail: NTIS HC $24.40

An analytical design study for efficient traveling wave tubes and klystrons for use in a satellite television transmitter is described. The state of the art, characteristics, and design is discussed for traveling wave tubes, narrow band coupled activity traveling wave tubes, klystrons and electronic power conditioners. ESRO

N73-31111# Elektronikcentralen, Hoersholm (Denmark).
CONVOLUTIONAL CODING FOR PCM TELEMETRY Final Report
E. Paaske and N. Horstock Paris ESRO Mar. 1973 184 p refs
(Contract ESTEC-893/69)
(ESRO-CR-165) Avail: NTIS HC $11.25

A convolutional encoder and a sequential decoder are described; the two devices are designed to form in combination with existing equipment a real-time simulation system for space telemetry channels. The convolutional encoder is built as a universal instrument, programmable for any (systematic or nonsystematic) rate 1/2 or 1/3 code of constraint length $K < 48$ and data rates ranging from 1 bit/s to 90 kbit/s. The data are transmitted in frames and, at the receiver, are passed on to a Honeywell DDP-116 minicomputer, programmed to perform the sequential decoding. A convenient buffer monitor system has also been developed. The decoded data are recorded on tape and can be displayed. The decoding function of the computer has been optimized by minimizing the latter's input/output load. In almost every case where a choice had to be made, flexibility has been perferred to input data rate. Author (ESRO)

N73-31112# National Physical Lab., Teddington (England). Div. of Computer Science.
SIMULATION OF A PACKET-SWITCHED DATA NETWORK OPERATING WITH A REVISED LINK AND NODE PROTOCOL
W. L. Price Apr. 1973 44 p refs
(NPL-COM-68) Avail: NTIS HC $4.25

A revised node and link protocol for a packet-switched data network is described. Positive acknowledgement is used on the links and there is a queueing system for calls on the central processors of the nodes. The steps taken to simulate such a network are described, including, in an appendix, the full logical structure of the model. The results show that, if priority is given to through traffic, the network can cope with very heavy offered traffic; any that cannot be accepted at any given time is made to wait at an entrance to the network. Fixed routing of packets is used and it is shown that a routing matrix which spreads the load more evenly between the nodes is preferable. Multiple-packet transmission on the internode links is better than packet-at-a-time transmission, and the interval between packets must be kept fairly low. The model was created to simulate the network in such a way that it could be easily converted to operate in an isarithmic mode. Author (ESRO)

N73-31113# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y.
PHASED ARRAY ANTENNA EVALUATION STUDIES Final Technical Report, Apr. 1971 - Apr. 1972
Leopold B. Felsen, Alexander Hessel, George H. Knittel, Ralph Constantini, and Jacob Goldberg May 1973 8241 p refs
(Contract F30602-71-C-0316)
(AD-764367; PIBEP-73-128; RADC-TR-73-187) Avail: NTIS

The topics studied are: (1) multimode waveguide elements

for phased arrays, (2) finiteness effects in an E-plane array of parallel-plate waveguides, (3) a transition radiating element for wide-angle wide-band matching, and (4) ray methods for computation of mutual coupling on conformal arrays. (Modified author abstract) GRA

N73-31114# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.
STUDY OF OPTIMUM PULSE TRANSMISSION THROUGH A DISPERSION MEDIUM Final Report, 1 Dec. 1969 - 31 May 1973
Robert E. McIntosh 31 May 1973 7 p refs
(Contract DA-ARO(D)-31-124-72-G62;
DA-ARO(D)-31-124-72-G196)
(AD-764281; AROD-8273-2-P) Avail: NTIS CSCL 20/14

The propagation of electromagnetic signals through ionized media was studied with the goal of relating characteristics of transmitted signals to the physical properties of gaseous plasmas. In particular, methods of optimum transmission were considered using a knowledge of the dispersive and nondeterministic properties of naturally occurring ionized media such as the ionosphere. Author (GRA)

N73-31115# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
TROPOPLOT: AN IMPROVED FORTRAN COMPUTER PROGRAM FOR PREDICTION OF LONG-TERM MEDIAN TROSPHERIC RADIO TRANSMISSION LOSS OVER IRREGULAR TERRAIN M.S. Thesis
James Michael Callaghan Jun. 1973 46 p refs
(AD-764476) Avail: NTIS CSCL 17/2

The object of this study was to develop a highly accurate long range computer program to do predictions of tropospheric radio transmission loss over irregular terrain. The computer program was to be easy to use with an input and output data format such that the user could use the program with little prior instruction. Signal strength calculation capability was also to be included in the program. The basis for the program theory was ESSA Research Report number ERL 67-ITS 67, Prediction of Tropospheric Radio Transmission Loss Over Irregular Terrain. Author (GRA)

N73-31116# Naval Postgraduate School, Monterey, Calif.
COMMUNICATIONS SYSTEMS TEST PROCEDURES M.S. Thesis
Andre Christophe Simonpietri, Jr. Mar. 1973 95 p refs
(AD-764485) Avail: NTIS CSCL 17/2

Several recent studies of Naval Communications have determined that the system is not operating properly. The paper presents a test procedure which will improve the performance of the equipment that composes the communications system. The need for a test procedure, modes of failure and present test procedures are examined. It is determined that present test procedures referred to as system level tests are mislabelled and are actually subsystems level tests. A Systems Level Test, the Standard Measurement Technique (SMT) which applies inputs of known degradation to a system and quantifies the output is presented. Present problems and potential applications of SMT are discussed. Author (GRA)

N73-31117# Naval Research Lab., Washington, D.C.
STANDARD DIGITAL DATA CLOCK RATE GENERATOR WITH PROGRAMMABLE DIGITAL PHASE SHIFT Final Report
James P. Spraitz and Gerald J. Hilwig 29 Jun. 1973 23 p refs
(RF21222401)
(AD-764049; NRL-7572) Avail: NTIS CSCL 17/2

To perform research and development of satellite-communications circuits, subsystems, and system concepts, a device was designed to generate standard digital data clock rates and to provide continuous, programmable digital phase-shift control to permit synchronization of the output signal to other system signals. This equipment provides data clock rates of 38,400, 19,200, 9600, 4800, 2400, 1200, 600, 300, 150, 75, and 37.5 Hz based on a 1-MHz input signal from a frequency standard. Author (GRA)

N73-31118# Naval Research Lab., Washington, D.C.
USE OF A SELF-FOCUSING ANTENNA FOR LOW-ANGLE TRACKING Final Report
James H. Hughen 28 Jun. 1973 20 p
(RF12151402)
(AD-764052; NRL-7579) Avail: NTIS CSCL 17/9

The response of a self-focusing antenna to two closely spaced point targets is investigated. The geometry simulated corresponds to the radar tracking of a low-flying target over a reflective surface. In one case the antenna consists of a vertical linear array of elements. When the conjugates of the incident signals are retransmitted at each element, after several iterations the antenna radiation pattern introduces significant discrimination against the weaker of the two unresolvable point targets. In the other case the same aperture is divided into two equal subapertures, and conjugate reflections are applied to the two subapertures rather than to each element. It is found that very nearly the same weak-target discrimination results. The implications of these results with regard to low-angle tracking are discussed. Author (GRA)

N73-31119# Auburn Univ., Ala. Dept. of Electrical Engineering.
SEL86 OPERATING SYSTEM AND MULTIPATH STUDY Interim Technical Report, 8 Aug. 1972 - 15 Apr. 1973
E. R. Graf and H. T. Nagle, Jr. 15 Apr. 1973 36 p refs
(Contract DAAH01-71-C-1303)
(AD-763940) Avail: NTIS CSCL 17/9

The report discusses the SEL 86 radar operating system, a collection of programs that controls the radar, collects data and communicates with the operator. There are three major levels to this system. The inner most level is the NUCLEUS whose main purpose is to provide process synchronizing and basic resource allocation. The next level is the SUPERVISOR which provides an interface to the NUCLEUS and input/output and other services to the control programs. The outer level is made up of the RADAR CONTROL PROGRAMS which performs the actual radar control functions. The report contains two articles: SEL 86 Radar Operating System, and Frequency Agility to Reduce Multipath Pointing Errors. GRA

N73-31120# Army Weapons Command, Rock Island, Ill. Procurement Policy and Industrial Readiness Div.
MTI (MOVING TARGET INDICATORS): TRACKING OF A REENTRY VEHICLE IN STRONG ATTACHED WAKE
M. Arm and I. Weissman 15 Jun. 1973 16 p refs
(Contract DAAD07-72-C-0128)
(AD-763944; RRI-TM-64/241-4-60) Avail: NTIS CSCL 17/9

The memorandum presents data which demonstrate the utility of MTI clutter cancellation techniques for improving the tracking of reentry vehicles in the presence of strong wake echoes. GRA

N73-31121# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
MICOM EXPERIMENTAL ARRAY RADAR DIGITAL SIGNAL PROCESSOR
James F. Lancaster 22 Feb. 1973 32 p refs
(DA Proj. 1M2-62303-A-214)
(AD-764227; RE-73-14) Avail: NTIS CSCL 17/9

A detailed description of the digital signal processor used with the MICOM Experimental Array Radar (EAR) is presented in this report. The EAR system is a C-band, monopulse, phased array radar designed to perform the functions of sector search and target track for air defense applications. The signal processor samples range returns in real time at a 5-MHz rate to provide various processing functions for the radar. The basic functions provided by the signal processor are: clutter rejection, signal-to-noise improvement, threshold detection, and information for range and angle tracking. Author (GRA)

N73-31122# Hawaii Univ., Honolulu. Water Resources Research Center.
DIRECT DETERMINATION OF THE ELECTROMAGNETIC REFLECTION PROPERTIES OF SMOOTH BRACKISH WATER TO THE CONTINUOUS SPECTRUM FROM 10 TO THE 8TH POWER TO 4 x 10 TO THE 9TH POWER HERTZ
Larry K. Lepley and William M. Adams May 1971 93 p refs
(PB-221372/6TR-48; OWRR-B-015-HI(5)) Avail: NTIS HC

$4.85 CSCL 07D

A new geophysical technique for the remote measurement of the electromagnetic properties of natural surfaces was investigated. Theoretical and laboratory work has produced evidence for the validity of the use of ultra-high frequency radio reflection spectrometry for remote sensing of salinity of brackish water. A preliminary study of the electromagnetic properties of aqueous sodium chloride, computer-generated frequency dispersion curves of the dielectric coefficients, power reflectance, brightness temperature, and skin depth of water as a function of eight different normalities of sodium chloride, corresponding to a salinity range from pure to ocean water and as a function of five different temperatures from 0C to 40C to the radio frequency range from 10 to the 6th to 3 x 10 to the 10th power Hertz were constructed. A laboratory prototype radio reflection spectrometer was designed and assembled from commercially available swept-frequency UHF microwave test equipment, a single horn antenna, and a hand-made coaxial sample cell. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-31123 Michigan Univ., Ann Arbor.
ON-LINE INTERACTIVE COMPUTER SOLUTION OF DISPERSION EQUATIONS Ph.D. Thesis
John David Gillanders 1972 130 p
Avail: Univ. Microfilms Order No. 73-11121

An efficient general method of studying physical systems is considered whose behavior can be described in terms of a dispersion equation. An on-line interactive computer program was developed in order to minimize the amount of time required to study a given problem. The on-line method provides immediate feedback as to the effects produced by changes in the various parameters. Data input is fast and simple. The output is displayed graphically on a CRT for immediate observation. The method of studying the dispersion equations and searching for system instabilities is based on Briggs' criteria. A fast and efficient method of directly integrating the derivatives of the dispersion equations is used to trace the loci of the roots in the omega-k plane and to produce the conformal mapping of the omega-plane into the k-plane. Several examples are given in which this method is applied to investigate the interaction of an electron stream with a plasma. Examples of both convective instabilities and absolute instabilities are shown. The effects of variations in parameters such as plasma collision frequency and temperature are illustrated. Dissert. Abstr.

N73-31124 Washington Univ., St. Louis, Mo.
THE DESIGN OF A LANGUAGE FOR IMAGE PROCESSING (LIP1) Ph.D. Thesis
Carl McGrath Shinn, Jr. 1972 293 p
Avail: Univ. Microfilms Order No. 73-11824

Three selected existing languages (PAX 2, PL/1, and DIAL) are analyzed and compared with respect to their utility for expressing image processing concepts. Then mini-languages are designed to concentrate in each of six aspects of preprocessing and feature extraction: (1) input/output, (2) data structures, (3) points, (4) segments and lines, (5) windows and pictures, and (6) inhomogeneous operations. The input/output mini-language, ML1, permits a variable to be declared as residing in a given peripheral device. ML2 is the data structure mini-language. Homogeneous transformations of pictures are dealt with by ML3, ML4, and ML5. ML6 expresses inhomogeneous operations. Integration of the six mini-languages produces relatively sophisticated declaration and assignment statements, which express all the image processing primitives. LIP1 is a combination of these image processing statements with several types of traditional procedural statements, such a stop, loop, and conditional tests. Three sizeable programs in LIP1 are also included to demonstrate the power of the language. Dissert. Abstr.

N73-31125 Kansas Univ., Lawrence.
IMAGE ANALYSIS SYSTEMS Ph.D. Thesis
George William Dalke 1972 223 p
Avail: Univ. Microfilms Order No. 73-11874

A multi-image photo-interpretation system was designed, constructed, and used to process several types of photographs. The equipment consists of four synchronized flying spot scanners, a color display, and devices that perform the following processing functions: (1) brightness and contrast enhancement, (2) density level slice, (3) edge enhancement, (4) area measurement of sliced levels, (5) density probability distributions, (6) line scan modulation and display, (7) single line selection and profile display, (8) linear combination of multiple images and color display, (9) simultaneous enhancement and calibration, and (10) classification by multi-image signature detection. Test sites were set up, ground truth and imagery were collected, and various processing functions were tested. The multi-image classification experiments used four color separations made from an Ektachrome-Infrared image. Dissert. Abstr.

N73-31126 Ohio State Univ., Columbus.
TECHNIQUES FOR THE EVALUATION AND IMPROVEMENT OF COMPUTER-PRODUCED ABSTRACTS Ph.D. Thesis
Betty Ann Mathis 1972 276 p
Avail: Univ. Microfilms Order No. 73-11535

An automatic abstracting system, named ADAM, was implemented on the IBM 370. The ADAM receives journal articles as input and produces abstracts as output. An algorithm was developed which considers every sentence in the input text and rejects sentences which are not suitable for inclusion in the abstract. All sentences which are not rejected are included in the set of sentences which are candidates for inclusion in the abstract. The quality of the abstracts can be evaluated by means of a two-step evaluation procedure. The first step of the procedure determines the conformity of the abstracts to the defined criteria for an acceptable abstract for the given system. The second step provides an objective evaluation criterion for abstract quality based on a comparison of the abstract with its parent document. Based on the results of this evaluation, several techniques have been developed to improve the quality of the abstracts. Dissert. Abstr.

N73-31127 Johns Hopkins Univ., Baltimore, Md.
FEATURE EXTRACTION VIA THE GRAY LEVEL STRUCTURE OF IMAGERY Ph.D. Thesis
Martin Gerald Woolfson 1972 172 p
Avail: Univ. Microfilms Order No. 73-12172

Pattern classes composed of multiple gray level imagery can be recognized through processing of feature sets extracted from measures of the gray level or intensity structures of the patterns. The absence of geometric dependence in the feature extraction method leads to the development of feature sets which are invariant under the pattern perturbations of translation, rotation, and dilation. The gray level feature extraction process is developed for classes consisting of simple isolated patterns through complex pattern imagery consisting of gray level patterns embedded in structured backgrounds. The problem of employing the procedure for patterns embedded in structured backgrounds is treated from a number of points of view. Procedures are given for the computer generation and processing of synthetic gray level patterns for use in recognition experiments. To indicate the processing speed advantage of the gray level procedure, an experiment is performed which compares this procedure to a shape recognition method. The experiment indicates that the gray level procedure employing significantly less processing time, leads to predicted error bounds which are comparable to that of the shape procedure. Dissert. Abstr.

N73-31128*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIDY, A COMPLETE CODE FOR RENUMBERING AND EDITING FORTRAN SOURCE PROGRAMS. USER'S MANUAL FOR IBM 360/67
Alice V. Barlow and Garret N. Vanderplaats Aug. 1973 55 p ref Prepared in Cooperation with Computer Sci. Corp., Mt. View, Calif. and Army Air Mobility R and D Lab., Moffett Field, Calif. (NASA-TM-X-62286) Avail: NTIS HC $4.75 CSCL 09B

TIDY, a computer code which edits and renumerates FORTRAN decks which have become difficult to read because of many patches and revisions, is described. The old program is

reorganized so that statement numbers are added sequentially, and extraneous FORTRAN statements are deleted. General instructions for using TIDY on the IBM 360/67 Tymeshare System, and specific instructions for use on the NASA/AMES IBM 360/67 TSS system are included as well as specific instructions on how to run TIDY in conversational and in batch modes. TIDY may be adopted for use on other computers. Author

N73-31129# National Aeronautical Establishment, Ottawa (Ontario). Structures Section.
SRCH: A HEADLAMP RESEARCH PROGRAM FOR THE EXTRAPOLATION/INTERPOLATION OF SURFACE VALUES FROM A PREDEFINED GRID
Ann L. Harrison Jun. 1972 70 p
(LTR-ST-602) Avail: NTIS HC $5.50 CSCL 09B

Various methods are explored for describing the grid surface and for extracting the required surface values. Their implementation as part of the SRCH program is discussed. The source listing for the program and a sample execution are included. The program is written in Fortran for the IBM 360/67 TSS computer and utilizes a contour plotting package. Author

N73-31130*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
USE OF SPATIAL INFORMATION IN CLASSIFICATION OF REMOTELY SENSED DATA
D. L. VanRoony and M. S. Lynn May 1973 21 p
(Contract NAS9-12776)
(NASA-CR-133988; ICSA-275-025-009) Avail: NTIS HC $3.25 CSCL 09B

The use is discussed of spatial information for improving classification accuracy of remotely sensed data. In particular a simple example (the unanimous four nearest neighbor rule) is discussed and its results are presented. This algorithm results in improved classifications accuracy (one to five percentage points) and costs little in execution time. Other schemes for improving classification accuracy are also discussed. Author

N73-31131*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
DATA SMOOTHING AND ERROR DETECTION BASED ON LINEAR INTERPOLATION
V. M. Guerra and R. A. Tapia Sep. 1972 25 p refs
(Contract NAS9-12776)
(NASA-CR-133984; ICSA-275-025-006) Avail: NTIS HC $3.25 CSCL 05B

A method is presented, based on linear interpolation, for detecting and correcting bad data points in a set of data without contaminating the good data points. The method used is not concerned with the small random errors usually attributed to a noisy system. It assumes that the data points which are in error are relatively isolated from each other and that the number of such points is small compared to the total number of data points. Author

N73-31132*# Neoterics, Inc., Cleveland, Ohio.
NASIS DATA BASE MANAGEMENT SYSTEM - IBM 360/370 OS MVT IMPLEMENTATION. 1: INSTALLATION STANDARDS Final Report
Sep. 1973 24 p refs
(Contract NAS3-14979)
(NASA-CR-134470) Avail: NTIS HC $3.25 CSCL 09B

The installation standards for the NASA Aerospace Safety information System (NASIS) data base management system are presented. The standard approach to preparing systems documentation and the program design and coding rules and conventions are outlined. Included are instructions for preparing all major specifications and suggestions for improving the quality and efficiency of the programming task. Author

N73-31133*# Neoterics, Inc., Cleveland, Ohio.
NASIS DATA BASE MANAGEMENT SYSTEM - IBM 360/370 OS MVT IMPLEMENTATION. 2: OVERVIEWS Final Report
Sep. 1973 38 p refs
(Contract NAS3-14979)
(NASA-CR-134471) Avail: NTIS HC $4.00 CSCL 09B

The systems overviews of the NASA Aerospace Safety Information System (NASIS) are presented. The overviews are directed toward informing management of a system's capabilities and requirements. The intent of the overviews is to introduce the system features to interested individuals. Each overview contains a description of the component's activities and roles in the overall system. The description includes charts and diagrams and a discussion of the performance requirements and growth potential of the module. Author

N73-31134*# Neoterics, Inc., Cleveland, Ohio.
NASIS DATA BASE MANAGEMENT SYSTEM - IBM 360/370 OS MVT IMPLEMENTATION. 3: DATA SET SPECIFICATIONS
Sep. 1973 202 p refs 7 Vol.
(Contract NAS3-14979)
(NASA-CR-134472) Avail: NTIS HC $12.25 CSCL 09B

The data set specifications for the NASA Aerospace Safety Information System (NASIS) are presented. The data set specifications describe the content, format, and medium of communication of every data set required by the system. All relevant information pertinent to a particular set is prepared in a standard form and centralized in a single document. The format for the data set is provided. Author

N73-31135*# Neoterics, Inc., Cleveland, Ohio.
NASIS DATA BASE MANAGEMENT SYSTEM - IBM 360/370 OS MVT IMPLEMENTATION. 4: PROGRAM DESIGN SPECIFICATIONS
Sep. 1973 590 p refs 7 Vol.
(Contract NAS3-14979)
(NASA-CR-134473) Avail: NTIS HC $31.50 CSCL 09B

The design specifications for the programs and modules within the NASA Aerospace Safety Information System (NASIS) are presented. The purpose of the design specifications is to standardize the preparation of the specifications and to guide the program design. Each major functional module within the system is a separate entity for documentation purposes. The design specifications contain a description of, and specifications for, all detail processing which occurs in the module. Sub-modules, reference tables, and data sets which are common to several modules are documented separately. Author

N73-31136*# Neoterics, Inc., Cleveland, Ohio.
NASIS DATA BASE MANAGEMENT SYSTEM - IBM 360/370 OS MVT IMPLEMENTATION. 5: RETRIEVAL COMMAND SYSTEM REFERENCE MANUAL
Sep. 1973 74 p refs 7 Vol.
(Contract NAS3-14979)
(NASA-CR-134474) Avail: NTIS HC $5.75 CSCL 09B

The retrieval command subsystem reference manual for the NASA Aerospace Safety Information System (NASIS) is presented. The output oriented classification of retrieval commands provides the user with the ability to review a set of data items for verification or inspection as a typewriter or CRT terminal and to print a set of data on a remote printer. Predefined and user-definable data formatting are available for both output media. Author

N73-31137*# Neoterics, Inc., Cleveland, Ohio.
NASIS DATA BASE MANAGEMENT SYSTEM - IBM 360/370 OS MVT IMPLEMENTATION. 6: NASIS MESSAGE FILE
Sep. 1973 150 p refs 7 Vol.
(Contract NAS3-14979)
(NASA-CR-134475) Avail: NTIS HC $9.50 CSCL 09B

The message file for the NASA Aerospace Safety Information System (NASIS) is discussed. The message file contains all the message and term explanations for the system. The data contained in the file can be broken down into three separate sections: (1) global terms, (2) local terms, and (3) system messages. The various terms are defined and their use within the system is explained. Author

N73-31138*# Neoterics, Inc., Cleveland, Ohio.
NASIS DATA BASE MANAGEMENT SYSTEM - IBM 360/370 OS MVT IMPLEMENTATION. 7: DATA BASE ADMINISTRATOR USER'S GUIDE
Sep. 1973 180 p refs 7 Vol.
(Contract NAS3-14979)
(NASA-CR-134476) Avail: NTIS HC $11.00 CSCL 09B

The Data Base Administrator User's Guide for the NASA Aerospace Safety information system is presented. The subjects discussed are: (1) multi-terminal tasking, (2) data base executive, (3) utilities, (4) maintenance, and (5) update mode functions.
Author

N73-31139# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
A SYNCHRONOUS SATELLTIE TIME DELAY COMPUTER
Wallace F. Hamilton and D. Wayne Hanson Jul. 1973 35 p refs
(NBS-TN-638) Avail: SOD HC $0.45 as C13.46:638

A special purpose slide rule designed to compute the free space propagation delay between a synchronous satellite and points on the earth's surface is discussed. The slide rule was developed to provide users of time information relayed by geostationary satellites a means of computing the propagation delays without dealing directly with the satellite's orbital elements. The delays computed with the slide rule are compared with the values obtained from orbital elements using a high precision digital computer. The limitations and accuracy of the slide rule are discussed. A sample slide rule which may be cut out and used is included in the report.
Author

N73-31140# National Bureau of Standards, Washington, D.C. Computer Systems Section.
ANNOTATED BIBLIOGRAPHY OF THE LITERATURE ON RESOURCE SHARING COMPUTER NETWORKS Interim Report, Fourth Quarter, 1973
R. P. Blanc, I. W. Cotton, T. N. Pyke, Jr., and S. W. Watkins Sep. 1973 96 p refs
(Grant NSF AG-350; NBS Proj. 6502372)
(NBS-SP-384; LC-73-600268) Avail: SOD HC $1.25 as C13.10:384

A bibliography consisting of references with critical annotations to the literature on computer networks is presented. A classification scheme was developed to place each annotation in a category reflective of its content. Five indexes to the bibliography are included: author index, corporate author index, network index, key word out of context index, and report number index.
Author

N73-31141*# Intermetrics, Inc., Cambridge, Mass.
GOAL-TO-HAL TRANSLATION STUDY Final Report
J. H. Flanders, C. T. Helmers, and S. F. Stanten Jun. 1973 85 p
(Contract NAS9-12291)
(NASA-CR-134033) Avail: NTIS HC $6.25 CSCL 09B

This report deals with the feasibility, problems, solutions, and mapping of a GOAL language to HAL language translator. Ground Operations Aerospace Language, or GOAL, is a test-oriented higher order language developed by the John F. Kennedy Space Center to be used in checkout and launch of the space shuttle. HAL is a structured higher order language developed by the Johnson Space Center to be used in writing the flight software for the onboard shuttle computers. Since the onboard computers will extensively support ground checkout of the space shuttle, and since these computers and the software development facilities on the ground use the HAL language as baseline, the translation of GOAL to HAL becomes significant. The issue of feasibility was examined and it was found that a GOAL to HAL translator is feasible. Special problems are identified and solutions proposed. Finally, examples of translation are provided for each category of complete GOAL statement.
Author

N73-31142*# Intermetrics, Inc., Cambridge, Mass.
SHUTTLE AVIONICS AND THE GOAL LANGUAGE INCLUDING THE IMPACT OF ERROR DETECTION AND REDUNDANCY MANAGEMENT Final Report
J. H. Flanders, C. T. Helmers, and S. F. Stanten Jun. 1973 63 p
(Contract NAS9-12291)
(NASA-CR-134034) Avail: NTIS HC $5.25 CSCL 09B

The relationship is examined between the space shuttle onboard avionics and the ground test computer language GOAL when used in the onboard computers. The study is aimed at providing system analysis support to the feasibility analysis of a GOAL to HAL translator, where HAL is the language used to program the onboard computers for flight. The subject is dealt with in three aspects. First, the system configuration at checkout, the general checkout and launch sequences, and the inventory of subsystems are described. Secondly, the hierarchic organization of onboard software and different ways of introducing GOAL-derived software onboard are described. Also the flow of commands and test data during checkout is diagrammed. Finally, possible impact of error detection and redundancy management on the GOAL language is discussed.
Author

N73-31143*# Aerophysics Research Corp., Houston Tex.
DIALOG: AN EXECUTIVE COMPUTER PROGRAM FOR LINKING INDEPENDENT PROGRAMS Technical Note, Jun. 1972 - Jun. 1973
C. R. Glatt, D. S. Hague, and D. A. Watson Sep. 1973 130 p refs
(Contract NAS9-12829)
(NASA-CR-134032; JTN-01) Avail: NTIS HC $8.50 CSCL 09B

A very large scale computer programming procedure called the DIALOG Executive System has been developed for the Univac 1100 series computers. The executive computer program, DIALOG, controls the sequence of execution and data management function for a library of independent computer programs. Communication of common information is accomplished by DIALOG through a dynamically constructed and maintained data base of common information. The unique feature of the DIALOG Executive System is the manner in which computer programs are linked. Each program maintains its individual identity and as such is unaware of its contribution to the large scale program. This feature makes any computer program a candidate for use with the DIALOG Executive System. The installation and use of the DIALOG Executive System are described at Johnson Space Center.
Author

N73-31144# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario). Biosciences Div.
DIGITAL COMPUTATION OF DECOMPRESSION PROFILES
R. Y. Nishi and L. A. Kuehn Jan. 1973 29 p refs
(DCIEM-884) Avail: NTIS HC $3.50

A pneumatic analogue decompression computer is described and used for the real-time prediction of the safe ascent depth following an excursion to depth. The theoretical model which is derived from the decompression computer can be solved using numerical techniques on a digital computer, or can be solved on an analogue computer. A series of Fortran IV programs are described which have been written to solve this theoretical model under a variety of conditions. The basic program can be used to calculate the safe ascent depth for a standard dive or for repetitive dives, and if desired, the safe ascent height for flying after diving. Modifications to the basic program are described which permit the use of the model for applications such as the design of pneumatic computers and the analysis of decompression tables.
Author

N73-31145*# Auburn Univ., Ala. Engineering Experiment Station.
FLOATING-POINT SYSTEM QUANTIZATION ERRORS IN DIGITAL CONTROL SYSTEMS Final Technical Report
C. L. Phillips Jun. 1973 73 p refs
(Contract NAS8-28262)
(NASA-CR-124382) Avail: NTIS HC $5.75 CSCL 09B

The results are reported of research into the effects on system operation of signal quantization in a digital control system. The investigation considered digital controllers (filters) operating in floating-point arithmetic in either open-loop or closed-loop systems. An error analysis technique is developed, and is implemented by a digital computer program that is based on a digital simulation of the system. As an output the program gives the programing form required for minimum system quantization errors (either maximum of rms errors), and the maximum and rms errors that appear in the system output for a given bit configuration. The program can be integrated into existing digital simulations of a system.
Autho

N73-31146*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ROBOT COMPUTER PROBLEM SOLVING SYSTEM Quarterly Progress Report, 1 Apr. - 30 Jun. 1973
E. William Merriam and Joseph D. Becker 15 Jul. 1973 28 p
(Contract NASw-2236)
(NASA-CR-133942; QPR-6; BBN-2615) Avail: NTIS HC $3.50 CSCL 09B

A robot computer problem solving system which represents a robot exploration vehicle in a simulated Mars environment is described. The model exhibits changes and improvements made on a previously designed robot in a city environment. The Martian environment is modeled in Cartesian coordinates; objects are scattered about a plane; arbitrary restrictions on the robot's vision have been removed; and the robot's path contains arbitrary curves. New environmental features, particularly the visual occlusion of objects by other objects, were added to the model. Two different algorithms were developed for computing occlusion. Movement and vision capabilities of the robot were established in the Mars environment, using LISP/FORTRAN interface for computational efficiency. The graphical display program was redesigned to reflect the change to the Mars-like environment. K.M.M.

N73-31147*# Pennsylvania State Univ., University Park. Ionospheric Research Lab.
D-REGION BLUNT PROBE DATA ANALYSIS USING HYBRID COMPUTER TECHNIQUES
William John Burkhard 28 Jun. 1973 177 p
(Grant NGR-39-009-218; DA-ARO(D)-31-124-72-G158)
(NASA-CR-135646; PSU-IRL-SCI-415) Avail: NTIS HC $11.00 CSCL 09B

The feasibility of performing data reduction techniques with a hybrid computer was studied. The data was obtained from the flight of a parachute born probe through the D-region of the ionosphere. A presentation of the theory of blunt probe operation is included with emphasis on the equations necessary to perform the analysis. This is followed by a discussion of computer program development. Included in this discussion is a comparison of computer and hand reduction results for the blunt probe launched on 31 January 1972. The comparison showed that it was both feasible and desirable to use the computer for data reduction. The results of computer data reduction performed on flight data acquired from five blunt probes are also presented. Author

N73-31148*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla. LV/Checkout Automation and Programming Office/LV-CAP.
GROUND OPERATIONS AEROSPACE LANGUAGE (GOAL): SYNTAX DIAGRAMS HANDBOOK
Larry R. Dickison 16 Apr. 1973 55 p
(NASA-TM-X-69505; KSC-TR-1213) Avail: NTIS HC $4.75 CSCL 09B

A syntactical representation of each GOAL statement is given. The language specification is usable for related software/language interfaces, i.e. compilers, translators, etc. Author

N73-31149*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SOURCE ENCODING FOR TWO-DIMENSIONAL DATA Final Report
Paul A. Wintz Apr. 1973 18 p refs
(Grant NGR-15-005-106)
(NASA-CR-132796; TR-EE-73-11) Avail: NTIS HC $3.00 CSCL 09B

Abstracts are presented of research conducted on source encoding for two-dimensional data. A.L.

N73-31150# California Univ., Livermore. Lawrence Livermore Lab.
LLL ELECTRON AND PROTON SPECTROMETER ON NASA'S ORBITING GEOPHYSICAL OBSERVATORY 5, THE DATA USER'S GUIDE TO THE MICROFILM RECORDS
H. I. West, Jr. 20 Dec. 1972 60 p refs
(Contract W-7405-eng-48)
(UCRL-51307) Avail: NTIS HC $5.45

Background is provided for using data from the energetic-particle experiment conducted on OGO-5. These data were plotted on both 20-minute and 2-hour scales. Data from the UCLA magnetometer experiment were plotted to the 20-minute scale for correlative purposes. In addition, tables of pertinent attitude-orbit data were plotted. Many of these data are available on microfilm from the National Space Science Data Center. Author (NSA)

N73-31151*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RALPH: AN ONLINE COMPUTER PROGRAM FOR ACQUISITION AND REDUCTION OF PULSE HEIGHT DATA
R. C. Davies, R. S. Clark, and J. E. Keith Idaho Falls, Idaho Aerojet Nucl. Co. Apr. 1973 427 p Prepared in cooperation with Aerojet Nucl. Co.
(NASA Order T-91867; Contract AT(10-1)-1375)
(NASA-TM-X-69507; ANCR-1103) Avail: NTIS HC $23.50 CSCL 09B

A background/foreground data acquisition and analysis system incorporating a high level control language was developed for acquiring both singles and dual parameter coincidence data from scintillation detectors at the Radiation Counting Laboratory at the NASA Manned Spacecraft Center in Houston, Texas. The system supports acquisition of gamma ray spectra in a 256 x 256 coincidence matrix (utilizing disk storage) and simultaneous operation of any of several background support and data analysis functions. In addition to special instruments and interfaces, the hardware consists of a PDP-9 with 24K core memory, 256K words of disk storage, and Dectape and Magtape bulk storage. Author (NSA)

N73-31152# AEG-Telefunken, Konstanz (West Germany).
SYSTEM DESCRIPTION OF THE DIGITAL COMPUTER TR 16 [SYSTEMBESCHREIBUNG DES DIGITALRECHNERS TR 16]
R. Klett Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Jul. 1972 53 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-22) Avail: NTIS HC $4.75; ZLDI, Munich 10,80 DM

After a basic description and some information on general characteristics of the stored program digital computer TR 16 to be used onboard spacecraft, the representation of data and instructions and the addressing modes of this computer are defined. A listing of the instruction set is followed by a description of the structure of the registers and different units. The packaging and the components are described as well as the required software. Technical data of TR 16 are given. Author (ESRO)

N73-31153# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
SOME VALIDATION TESTS FOR AN ALGOL 60 COMPILER
B. A. Wichmann Mar. 1973 70 p refs
(NPL-NAC-33) Avail: NTIS HC $5.50

About a hundred ALGOL 60 test programs available to validate a compiler are detailed. All the tests were checked by executing them on two compilers that were available on KDF9. Comments on how the compilers handled the tests are included. Interpreting the results of the test programs requires a good knowledge of ALGOL 60. ESRO

N73-31154# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE DEFINITION OF COMMENTS IN PROGRAMMING LANGUAGES
R. S. Scowen and B. A. Wichmann May 1973 24 p refs
(NPL-NAC-34) Avail: NTIS HC $3.25

The concept of comments in programming languages such as ALGOL 60, PL/1, PL/300, BABEL, PI/516, ALGOL 68, FORTRAN, BASIC, APL, COBOL, and LISP was examined. Design criteria for comments are presented. Suggested comment facilities in new programming languages are outlined. ESRO

N73-31155*# Hawaii Univ., Honolulu.
THE ALOHA SYSTEM INTERFACE TO TSO (TIME SHARING OPERATION)

John Davidson May 1972 35 p refs
(Contract NAS2-6700; F44620-69-C-0030; AF Proj. 7921)
(NASA-CR-133853; AD-746051; B72-3; AFOSR-72-1312TR)
Avail: NTIS HC $3.75 CSCL 09/2

The report describes the two assembly language programs required to interface THE ALOHA SYSTEM'S radio-linked peripherals to IBM'S Telecommunications Access Method (TCAM) under the Time Sharing Option (TSO) of the IBM 360 MVT Operating System. Included is a discussion of the EXCP Interface which intercepts and user packets and status information with THE ALOHA SYSTEM'S Hewlett-Packard 2115A minicomputer. The interface in its general form may be used in any TCAM-TSO configuration to enable the use of non-TCAM-supported terminals with TSO. Author (GRA)

N73-31156# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROGRAM MODEL OF THE OPTIMIZATION OF RELIABILITY CHARACTERISTICS OF A REDUNDANT DIGITAL COMPUTER
I. I. Ladygin and V. A. Frolov 2 Jul. 1973 8 p Transl. into ENGLISH from Tr. Energ. Inst. (USSR), no. 121, 1972 p 128-130
(AD-763261; FTD-HT-23-729-73) Avail: NTIS CSCL 09/2

The problem is considered of improving the criteria of reliability in the design of specialized digital computers. The case is examined of a digital computer which consists of five devices, where the failure of one of them leads to the failure of the whole computer. The problem consists of introducing a system of operative checks for each device, and the need to accomplish doubling of certain devices. An algorithm is developed which provides an adequate solution. D.L.G.

N73-31157# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALGORITHM FOR CALCULATING CORRECTING SIGNALS ON A HIGH SPEED DIGITAL COMPUTER
A. N. Latkov 24 Jul. 1973 11 p refs Transl. into ENGLISH from Vopr. Ekspluatatsii i Primeneniya Vychislitelnoi Tekhn. v Grazhdanskoi Aviatsii (USSR), no. 207, 1971
(AD-764310; FTD-HT-23-730-73) Avail: NTIS CSCL 01/3

Linear algorithms of discrete correction of the coordinates of an aircraft are considered. It is shown that the correction determination breaks down into two problems: the problem of dynamics, and the problem of computation. The problem of dynamics is solved by selecting the coefficients within the laws of control, and the problem of computation is solved by determining the correcting signals. Previously constructed algorithms are combined to formulate the proposed solution. D.L.G.

N73-31158# Douglas Aircraft Co., Inc., Long Beach, Calif.
FORMAT-FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 2, SUPPLEMENT 4: DESCRIPTION OF DIGITAL COMPUTER PROGRAM-EXTENDED Final Report, 1 May 1971 - 30 Apr. 1973
L. Chahinian and S. H. Miyawaki Wright-Patterson AFB, Ohio AFFDL Apr. 1973 106 p refs
(Contract F33615-71-C-1627; AF Proj. 1467)
(AD-764360; DAC-33569-Vol-2-Suppl-4;
AFFDL-TR-66-207-Vol-2-Suppl-4) Avail: NTIS CSCL 09/2

The FORMAT System has been augmented with highly efficient and reliable procedures for structural analysis via an alternate solution approach which combines the rigorous generation features of the existing force method with a new equation solving process characteristic of current displacement methods. As a result, a tenfold increase in potential problem size to in excess of 10,000 elastic degrees of freedom is the minimum currently anticipated as attainable on present major digital computers, and linear behavioral characteristics can take immediate advantage of any advance in hardware capabilities. In making these provisions, considerable emphasis was placed on the control of both physical and numerical error throughout the total solution process. To date an extensive range of complex configurations representing actual aerospace structures with up to 6500 degrees of freedom have been successfully processed as single entities on a production basis, that is, within the confines of a production schedule and with maximum reliability at minimum cost. Complete machine independence has been maintained in this latest release of FORMAT and many additions and refinements incorporated which either complement the efficiency afforded by the alternate solution approach or provide increased generality and reliability of the program. (Modified author abstract) GRA

N73-31159# Douglas Aircraft Co., Inc., Long Beach, Calif.
FORMAT-FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 5, SUPPLEMENT 2: ENGINEERING USER AND TECHNICAL REPORT-EXTENDED Final Report, 1 May 1971 - 30 Apr. 1973
J. Pickard Wright-Patterson AFB, Ohio AFFDL Apr. 1973 141 p refs
(Contract F33615-71-C-1627; AF Proj. 1467)
(AD-763812; DAC-33569-Vol-5-Suppl-2;
AFFDL-TR-66-207-Vol-5-Suppl-2) Avail: NTIS CSCL 20/11
For abstract, see N73-31158

N73-31160# Douglas Aircraft Co., Inc., Long Beach, Calif.
FORMAT-FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 6, SUPPLEMENT 2: DESCRIPTION OF DIGITAL COMPUTER PROGRAM PHASE 1-EXTENDED Final Report, 1 May 1971 - 30 Apr. 1973
R. C. Morris Wright-Patterson AFB, Ohio AFFDL Apr. 1973 111 p refs
(Contract F33615-71-C-1627; AF Proj. 1467)
(AD-764366; DAC-33569-Vol-6-Suppl-2;
AFFDL-TR-66-207-Vol-6-Suppl-2) Avail: NTIS CSCL 09/2
For abstract, see N73-31158

N73-31161# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
A METHOD FOR MANIPULATION OF DIGITAL COMPUTER SOURCE PROGRAMS
Larmon Sherrill Isom 1 Mar. 1973 33 p refs
(DA Proj. 1X2-63306-D-073)
(AD-764225; RG-73-6) Avail: NTIS CSCL 19/4

The report contains a detailed discussion of a method that can be used for manipulation of XDS Sigma 5/7 digital computer source programs. The method eliminates the necessity for handling large numbers of source program cards each time a source program is to be executed by a digital computer. An example, used to document the technique, is from the simulation effort on the Cannon Launched Guided Projectile. Author (GRA)

N73-31162# White Sands Missile Range, N.Mex. Instrumentation Directorate.
ERRORS IN FRACTIONAL INTEGER PROGRAMMING Final Report
John C. Davies Jun. 1973 214 p refs
(AD-763206; STEWS-ID-I-73-2) Avail: NTIS CSCL 12/2

The generation and propagation of numerical error in the fractional integer program was examined. The developments of error propagation in methods of matrix inversion were partially extended to both the continuous and discrete linear programs. It was shown that, because of the constraints imposed by the linear and integer programs on pivot selection, the strict upper bounds and characterization of error growth in matrix inversion did not apply. It was further shown that the rate of error growth in the integer linear program can be far greater than that for the linear program in continuous variables. The effect of numerical error in decision variables on behavior of an algorithm to solve the fractional integer program was examined. Methods for monitoring and controlling the growth of numeric error in the integer program were examined. The interaction of a group of source-selection rules with a group of dual (entering variable) rules was examined. GRA

N73-31163# International Business Machines Corp., San Jose, Calif. Information Sciences Dept.
DESIGN TECHNIQUES FOR DATA-BASE-ORIENTED COMPUTER NETWORKS
R. G. Casey and T. D. Friegdman Apr. 1973 83 p refs
(Contract N00014-72-C-0299)
(AD-763791) Avail: NTIS CSCL 09/2

The goal of the project reported here is to investigate basic techniques for ensuring efficient information flow in a distributed data base network. The report consists of five sections: Design

of Tree Networks for Distributed Data; The Ordering of Operations in Distributed Data Net Design; A System of APL Functions to Study Computer Networks; Directory Organization in an Information Network; Allocation of Time Slots in an Alternating-mode Network. GRA

N73-31164# Illinois Univ., Urbana. Computer-Based Education Research Lab.
DATA MANIPULATION AND SENSING IN THE PLASMA DISPLAY/STORAGE PANEL Final Report, 1 Jan. - 31 Dec. 1972
W. J. Coates, R. L. Johnson, and L. F. Weber Griffiss AFB, N. Y. RADC May 1973 78 p refs
(Contract F30602-72-C-0141)
(AD-763110; RADC-TR-73-131) Avail: NTIS CSCL 09/2

A program to study and develop data manipulation and sensing techniques for large scale plasma display/memory panels has been completed. The program consisted of three primary tasks: the investigation, development, and evaluation of techniques for extracting stored information from large scale plasma/display memory panels via direct electrical readout; the development and evaluation of techniques for manipulating data stored in the display with light pen systems; and the determination of the feasibility of realizing direct optical input systems using commercially available panels. (Modified author abstract) GRA

N73-31165# Cornell Univ., Ithaca, N.Y. Dept. of Computer Science.
ON THE KNAPSACK AND OTHER COMPUTATIONALLY RELATED PROBLEMS
Sartaj Kumar Sahni Aug. 1973 127 p refs
(Grant NSF GJ-33169)
(PB-221436/9; CU-CSD-73-172) Avail: NTIS HC $8.50 CSCL 12B

The author looks at several problems from areas such as network flows, game theory, artificial intelligence, graph theory, integer programming and nonlinear programming and shows that they are related in that any one of these problems is solvable in polynomial time if all the others are too. At present no polynomial time algorithm for these problems is known. These problems define an equivalence class of problems known as P- Complete. The partition and 0/1 Knapsack problems are members of this class of P-Complete problems. A technique is given which yields algorithms that have a worst case computing time that is a square root of that for previously known algorithms for these two problems. This technique is also applicable to some other P-Complete problems. A branch and search algorithm that is better than the previously known best branch and search algorithm (Greenberg and Hegerich) for the knapsack problem is also presented. (Modified author abstract) GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-31166 Michigan Univ., Ann Arbor.
NOISE CHARACTERISTICS OF AVALANCHE TRANSIT TIME MICROWAVE DIODES Ph.D. Thesis
Madhu Sudan Gupta 1972 221 p
Avail: Univ. Microfilms Order No. 73-11132

The noise behavior of avalanche transit-time diode microwave oscillators is studied. A quasi-static frequency domain analysis of the noise in negative resistance oscillators is applied to ATT oscillators thus determining the noise spectra for small frequency separations from the oscillation frequency in terms of the device and circuit impedances, and the noise voltage spectrum of the device. The device impedance is determined by means of a single frequency voltage-excited large signal analysis. A Read model of the diode with equal electron and hole ionization rates is employed. The noise voltage is primarily due to the randomness of the avalanche process and it is calculated using a small signal stationary Markovian model. It is found that circuit tuning can greatly influence the noise spectra because of the frequency sensitivity of the circuit impendance. Dissert. Abstr.

N73-31167 Kansas Univ., Lawrence.
A THEORETICAL STUDY OF THE HIGH FREQUENCY PERFORMANCE OF A SCHOTTKY BARRIER FIELD EFFECT TRANSISTOR FABRICATED ON A HIGH RESISTIVITY SUBSTRATE Ph.D. Thesis
Gary Dale Alley 1972 134 p
Avail: Univ. Microfilms Order No. 70-11847

The short circuit admittance parameters for a silicon Schottky barrier field effect transistor fabricated on a high resistivity substrate are calculated from first principles. The results of these calculations are valid up to frequencies beyond the maximum frequency of oscillation of the device. The maximum available gain of the device, as obtained from the y parameters, is given as a function of frequency. Dissert. Abstr.

N73-31168 Lehigh Univ., Bethlehem, Pa.
BREAKDOWN PROPERTIES OF TANTALUM OXIDE AND HAFNIUM OXIDE CAPACITORS Ph.D. Thesis
Joris M. Schuller 1972 245 p
Avail: Univ. Microfilms Order No. 73-10942

Breakdown tests have been carried out on Ta (TM and TMM) and Hf capacitors with thin self-healing counterelectrodes. Electric as well as thermal breakdown measurements have been made. In addition, leakage current I vs. field F measurements were carried out for TM and TMM capacitors in the Ta-positive direction at various temperatures. A very qualitative explanation for the poor correlation between leakage current and breakdown rate in TM and TMM capacitors has been proposed in which electrons in a defect band as well as in a conduction band contribute to the leakage current and only the latter electrons can cause breakdown. The steady state thermal breakdown strength for TM capacitors decreased with increasing temperature, capacitor area and decreasing dielectric thickness. Dissert. Abstr.

N73-31169 Michigan Univ., Ann Arbor.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF TRANSFERRED-ELECTRON AMPLIFIERS Ph.D. Thesis
Ashok Kumar Talwar 1972 253 p
Avail: Univ. Microfilms Order No. 73-11272

Stabilization of CW supercritical amplifiers has been shown to result from the increased lattice temperature and is due to the resulting changes in the velocity-field relationship. A new analysis is presented that describes the amplification process under these conditions and for arbitrarily large signal levels. Using Poisson's equation, the equation of current continuity, and the velocity-field relationship appropriate to the lattice temperature, a set of one-dimensional, large-signal equations is developed for a given dc current and fundamental RF driving current. Only dc and fundamental frequency RF electric fields are assumed to be important whereas the effects of current harmonics are included. Dc and RF electric fields are found as functions of time and distance from the cathode for the zero-field boundary condition. Effects of field-dependent diffusion have also been included as correction terms. By integration of the electric-field quantities over the total length of the device, the dc operating voltage and the RF impedance are obtained. The behavior of dc and RF impedances as functions of device parameters, operating bias, RF signal level and RF signal frequency was studied theoretically and experimental data is presented which qualitatively verifies the predicted results. Dissert. Abstr.

N73-31170 British Broadcasting Corp., Kingswood (England). Engineering Div.
MEDIUM FREQUENCY DIRECTIONAL AERIALS
L. K. Bradley Aug. 1973 12 p refs
Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The principal design considerations for highly directional medium frequency aerial arrays are presented together with a detailed calculation relating to a particular example of an in-line four-element directional array. Techniques for providing phase control and power splitting are also considered. Author

N73-31171*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

MULTIBEAM ANTENNA STUDY, PHASE 2 Final Report
Paul J. Byrnes 2 Jul. 1973 160 p
(Contract NAS5-21711)
(NASA-CR-132793; LMSC-D346314) Avail: NTIS HC $10.00 CSCL 09E

An antenna system concept for point to point communication between any two points in the Continental United States was developed using a synchronous orbit satellite. The design and fabrication of a two dimensional artificial dielectric lens contained in a parallel plate waveguide system is presented. The experimental pattern and voltage standing wave ratio results are listed from tests with four different lenses: a plano-convex natural dielectric (Teflon) lens, a plano-convex artificial dielectric lens, a two-point corrected Teflon lens, and a two-point corrected artificial dielectric lens. A computer simulated design of an operational two lens, 24 beam configuration is also presented. The computer design presents overlays of each beam onto the Continental United States from a fixed synchronous orbit satellite with a definition of these areas where beam-to-beam isolation is not sufficient to permit the reuse of frequency. Author

N73-31172*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
AVALANCHE DIODES FOR THE GENERATION OF COHERENT RADIATION Final Status Report, 16 Aug. 1972 - 28 Feb. 1973
Paul Penfield, Jr. 30 May 1973 90 p refs
(Grant NGL-22-009-337)
(NASA-CR-132300) Avail: NTIS HC $6.50 CSCL 09A

Solid state devices and characterization, and optimum imbedding networks for realizing best performance were investigated along with a barrier injection transit time diode. These diodes were investigated for possible application as microwave amplifiers and oscillators. Measurements were made of diode noise figures in the frequency ranges of 4 - 6 GHz. Initial results indicate that a noise figure of 6 - 8 db may be possible. Optimum device structure and fabrication techniques necessary for low noise performance were investigated. Previously published documents on electrodynamics are included. Author

N73-31173# Bendix Corp., Kansas City, Mo.
STRENGTH MEASUREMENTS ON TRANSISTOR HEADER LEAD WELDS Technological Spinoff Report
L. W. Siever Mar. 1973 21 p refs
(Contract AT(29-1)-613)
(BDX-613-871) Avail: NTIS HC $4.00

Tensile, shear, and peel strength measurements were performed on the common lead welds of TO-5 and TO-46 coin-type transistor headers. A product, representative of material presently available from transistor manufacturers was evaluated to develop a test which could be used for destructive lot sample acceptance criteria. The test results showed that a peel test performed by pulling the header lead parallel to the surface of the header base was sensitive to variations in the quality of the weld, and therefore could be used as an acceptance test on incoming transistor lots. The peel test was found superior to both tensile and shear tests as a lot sample acceptance test. Author

N73-31174# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
HIGHER ORDER FREQUENCY MULTIPLICATION USING STEP-RECOVERY DIODES [FREQUENZVERVIELFACHUNG HOHER ORDNUNG MIT LOESCHSPRUNGDIODEN (STEP-RECOVERY-DIODEN)]
K.-H. Doering Sep. 1972 34 p refs In GERMAN
(FTZ-A-46-TBR-5) Avail: NTIS HC $3.75

Theoretical principles for the selection of step recovery diodes for frequency multiplier circuits were developed, and the behavior of these diodes for frequency conversion investigated. The calculated and measured efficiency for frequency conversion was compared to that of other diodes. It was shown that the step recovery diode dominates in a broad frequency range with regard to continuous and nonreactive multiplication, which is determined by the parameters of the finite diode switching time. The development of a single stage 31-multiplier with an efficiency of 1.8 to 1.2% and a pulse 24-multiplier with an efficiency of 0.5% is reported. In particular, the influences of the average minority carrier lifetime and the finite switching time on efficiency are estimated. Complementary circuits were not found to be a economic solution to improving efficiency. ESRO

N73-31175# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
GAS SUPPLY SYSTEM FOR A 3 BY 3 km WAVEGUIDE TEST SECTION [GASBESCHICKUNGSANLAGE FUER EINE 3 X 3 km-HOHLKABELVERSUCHSSTRECKE]
W. Vorwerk Mar. 1972 19 p refs In GERMAN; ENGLISH summary
(FTZ-A-333-TBR-10) Avail: NTIS HC $3.00

A system is described which supplies nitrogen to a millimeter waveguide, as well as the protective PVC tubing surrounding it, and records oxygen and vapor content of the waveguide and tube. The set pressure, e.g. 0.1 atmospheric excess pressure, is kept constant, or, in case of a decrease, is automatically adjusted. In several frequency ranges, the attenuation of mm waves in a waveguide depends strongly upon the water vapor and oxygen content of the atmosphere within the waveguide. Since in the transmission range concerned, 21 to 60 GHz, dry nitrogen exhibits neutral behavior, it is advisable to fill waveguides with nitrogen. ESRO

N73-31176# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
DESIGN AND FUNCTION OF ANECHOIC FUNNEL AND RECTANGULAR CHAMBERS FOR ANTENNA TESTS
H. Hollmann Nov. 1971 67 p refs In GERMAN; ENGLISH summary
(FTZ-A-454-TBR-13) Avail: NTIS HC $5.50

Methods for measuring electromagnetic absorber reflectance and the design of anechoic chambers for microwave antenna measurements are presented. The reflectance of thick absorbers was determined according to the VSWR methods. The field strength distribution at the receiving point in a funnel chamber was computed and compared to the measured values. A model was used to test the function of a funnel chamber in the lower frequency range. For the determination of the reflectance, generally applicable rules were established in order to enable a comparison of the quality characteristics of different anechoic chambers. ESRO

N73-31177# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
MULTIMODE COAXIAL FEED FOR LARGE APERTURE PARABOLIC ANTENNAS [MEHRMODEN-KOAXIALERREGER FUER PARABOLANTENNEN MIT GROSSEM OEFFNUNGSWINKEL]
K. Seher Jul. 1972 26 p refs In GERMAN
(FTZ-A-454-TBR-14) Avail: NTIS HC $3.50

Multimode coaxial feeds for parabolic antennas with large aperture reflectors (up to 2 X 80 deg) are described. A high surface efficiency and/or a small radiation leakage can be obtained. The proposed models allow obtainment of a bandwidth of 6% and simultaneous good matching. The feeds consist of a round central radiator with H sub 11 waves, and a ring radiator with a mixture of H sub 11 and H sub 12 waves. A feed was tested with both a parabolic reflector of 2 X 70 deg and one of 2 X 80 deg. The surface efficiencies measured were 75 and 85% respectively. ESRO

N73-31178# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
INTRODUCTION TO CONCEPTION AND APPLICATION POSSIBILITIES OF PHASED ARRAYS [EINFUEHRUNG IN KONZEPTIONS- UND ANWENDUNGSMOEGLICHKEITEN PHASENGESTEUERTER GRUPPENANTENNEN]
K. P. Dombek Feb. 1972 24 p refs In GERMAN
(FTZ-A-454-TBR-15) Avail: NTIS HC $3.25

Principal construction and application of phased arrays is introduced. The different possibilities for varying the antenna radiation pattern by placing single elements as well as by phase and amplitude of the element feeds are discussed. The influence of the feed phase and the element distance is exemplified by using nomograms for straight equidistant elements. A survey of several conceptions of single element feeds in phased arrays is presented. The aspects of series feed, parallel feed, radiation

feed, network feed, and active radiator feed are explained. Possible future applications to satellites are indicated. ESRO

N73-31179# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
OMNIDIRECTIONAL ANTENNA WITH POLYGON REFLECTORS AND COSECANT RADIATION PATTERN FOR TELECASTING IN THE 12 GHz FREQUENCY RANGE [RUNDSTRAHLANTENNE IN POLYGONREFLEKTORBAUWEISE MIT KOSEKANSFOERMIGEM ELEVATIONSRICHTDIAGRAMM FUER DIE FERNSEHVERSORGUNG IM 12 GHz-FREQUENZBEREICH]
K. Hoffmann Apr. 1972 42 p refs In GERMAN
(FTZ-A-454-TBR-16) Avail: NTIS HC $4.25

The advantages of a new type of omnidirectional antenna with polygon reflectors for television broadcasting in the 12 GHz range and the difficulties in design are pointed out. This antenna structure permits a power saving and efficient coverage of an area around the transmitter, as a result of a cosecant radiation pattern. A further advantage is its adaptability to different coverage area geometries, as well as the possibility of being mounted on existing antenna masts. The method used for antenna design is explained, and experimental investigations of test arrangements are reported. ESRO

N73-31180# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
MEASUREMENT OF THE CHARACTERISTIC PARAMETERS OF STEP RECOVERY DIODES [MESSUNG DER CHARAKTERISTISCHEN PARAMETER VON STEP-RECOVERY-DIODEN (LOESCHSPRUNGDIODEN)]
K.-H. Doering Feb. 1972 30 p refs In GERMAN
(FTZ-A-651-TBF-3) Avail: NTIS HC $3.50

The mean minority carrier lifetime and the switching time of step recovery diodes were measured for their application to pulse generation in microwave equipment. Switching time was compared to reactance diode switching time. A demonstration circuit for the generation of needle pulses with 120 ps half width at 10 V amplitude shows the fast switching of these step recovery diodes. The switching properties and recovery behavior of the diodes were investigated for parametric upward converters, showing better properties than normal varactors. ESRO

N73-31181# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
ATTENUATION CALCULATIONS OF CIRCULARLY BENT WAVEGUIDES WITH DIELECTRIC COATINGS [DAEMPFUNGSBERECHNUNGEN AN KREISFOERMIG GEKRUEMMTEN DIELEKTRISCH BESCHICHTETEN HOHLKABELN]
G. Garlichs Nov. 1972 50 p refs In GERMAN; ENGLISH summary
(FTZ-A333-TBR-16) Avail: NTIS HC $4.50

The attenuation in a circularly bent waveguide with a dielectric coating was calculated. The influence of the thickness of the dielectric layer, the losses within the layer, and the radius of curvature was demonstrated by means of the TE sub 01 amplitude component, which is formed by coupling with the TM sub 11 mode. Since the TE sub 01 amplitudes at the location of the mode filters are known, it was possible to allow for the influence of these filters, and thus make an exact calculation of the attenuation as a function of the frequency. Here, strong attenuation variations of up to 0.6 db km were noticed with frequency variations of only some GHz. The bend attenuation was subdivided in a component caused by mixing of various modes, and another caused by the mode filters. In general, the last-mentioned component contributes most to total attenuation, depending on the number of filters. ESRO

N73-31182# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
ATTENUATION MEASUREMENTS OF HELICAL WAVEGUIDES IN THE 30 TO 70 GHz FREQUENCY RANGE [DAEMPFUNGSMESSUNGEN AN WENDELHOHLKABELN IM FREQUENZBEREICH 30 BIS 70 GHz]
H. Richter Nov. 1972 54 p refs In GERMAN; ENGLISH summary
(FTZ-333-TBR-17) Avail: NTIS HC $4.75

A description is given of a test console for performing attenuation measurements of waveguides in the EHF range. This test console operates according to the shuttle pulse method with frequency-shift keying. The power level is about 60 db lower than that of the radar equipment used up to now. This allows the use of backward-wave oscillators which can be varied over wide frequency ranges. The parameters of this test console and the section components additionally required were determined and proportioned. Statistical evaluation procedures were necessary due to the reduced signal-to-noise ratio. The reasons for measurement errors were investigated. The value of the whole measurement error was assumed to be about 0,25 db/km. A description is given of steps taken up to now to reduce the measurement error. Author (ESRO)

N73-31183# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
GUNN ELEMENTS FOR FAST DIGITAL CIRCUITS [GUNNELEMENTE FUER SCHNELLE DIGITALSCHALTUNGEN]
K. Mause Jun. 1972 40 p refs In GERMAN; ENGLISH summary
(FTZ-A-474-TBR-3) Avail: NTIS HC $4.00

Possible applications of planar Gunn devices in the dipole domain mode for fast logic circuits in, for instance, PCM equipment, were investigated. The thermal resistance of Gunn devices biased just below threshold was calculated and verified. It was shown that logic gates using Gunn devices with power consumptions of about 60 mW (including load resistors), and with delay times of about 30 ps, can be realized. Bit rates of over 5 Gbits/s can be accomodated. The packing density in monolithic integration can be made large enough to keep the capacitive load of the gate circuits sufficiently low. Gunn devices with large capacitive loads can be utilized as dynamic storage cells. The problem of Gunn device control to launch domains was investigated. Gate control is advantageous with respect to the largest possible Fan Out. A four step circuit of gate-controlled Gunn devices was constructed, with a delay of 40 ps per stage. Elementary circuits with Gunn devices for threshold logic are described. ESRO

N73-31184# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.
ON THE FAILURE ANALYSIS OF ELECTRONIC SEMICONDUCTOR ELEMENTS, ESPECIALLY BY MEANS OF METALLOGRAPHY
Rudolf Gohle 4 Jul. 1972 25 p refs In GERMAN; ENGLISH summary
(DLR-MITT-72-20) Avail: NTIS HC $3.25; DFVLR, Porz, West Ger. 9,80 DM

The failure analysis of semiconductor devices by means of metallographic method is discussed. Metallographic applications to integrated circuit manufacture are crystal structure, single crystal orientation, surface defects of chips. Some practical examples are given of application to failure analysis: bonding of aluminum contact wires, crystal structure of an aluminum contact wire, topography and thickness measurement of thin films, orientation of Si chips, and visualization of doping zones in emitter-collector short circuits. ESRO

N73-31185# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
NONLINEAR AND PARAMETRIC EFFECTS IN ELECTRON TRANSFER OSCILLATORS Final Report [ETUDE DES EFFETS NON LINEAIRES ET PARAMETRIQUES DANS LES OSCILLATEURS A TRANSFERT D'ELECTRONS RAPPORT FINAL]
F. Diamand Mar. 1972 56 p refs In FRENCH Original contains color illustrations
(Contract DGRST-70-72-355)
Avail: NTIS HC $5.00

Experimental methods for the determination of various dynamic characteristics of SHF electron transfer diodes are outlined. The principles of synchronization theory and synchronizer oscillators are presented. A technique for measuring high signal dynamic impedance applied only to electron transfer oscillators was considered. This method is compared to that of synchronization ellipse. In order to study the second harmonic tuning influence

on oscillator performance, a oscillator structure using two coupled diodes was developed. ESRO

N73-31186# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.
TELEVISION CAMERA TUBE LAG TESTER
James M. Moore 11 May 1973 34 p
(AD-763339; NADC-73030-20) Avail: NTIS CSCL 09/1

A unit was developed to provide a more versatile, convenient and inexpensive method of testing lag response in tv camera tubes. Lag is measured by exposing the tube to a step transition in irradiance and measuring the resultant transient response. The irradiance is provided by a 4 x 4 array of gallium arsenide phosphide light emitting diodes continually recycled on and off by a digital logic circuit. Controlling the on and off period permits the unit to be used in evaluating tubes which exhibit a wide range of lag response. A high degree of measurement accuracy is possible by use of a synchronizing trigger allowing for the observation of a single line of video. Details of the logic circuit operation, circuit diagrams, timing waveforms and a complete description of the operation controls are presented.
Author (GRA)

N73-31187*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIPOLE RECEIVER CHARACTERISTICS IN THE PRESENCE OF SEA WATER
Peter S. Kao 26 Dec. 1972 26 p refs
(Contract F19628-73-C-0002; AF Proj. 1508A)
(AD-763722; TN-1972-13; ESD-TR-72-358) Avail: NTIS CSCL 09/5

The receive properties for a dipole in the presence of sea water were obtained by solving integral equations for currents along the unloaded dipole and its image. For dipoles of 0.1 wavelength or higher above the sea surface, the performance resembled that of a dipole over a perfectly conducting plane; for dipoles within 0.1 wavelength above the sea surface, the relative gain dropped in about the same proportion as the relative reduction in the strength of the resultant electric field. An insulated wavelength/2 dipole with a conjugate load matched in free space had a relative power gain of 17 db below isotropic at the sea surface. Author (GRA)

N73-31188# Michigan Univ., Ann Arbor. Electron Physics Lab.
NOISE IN MICROWAVE SEMICONDUCTOR OSCILLATORS AND AMPLIFIERS Interim Report, 1 Jan. - 30 Nov. 1972
Madhu S. Gupta, George I. Haddad, Ronald J. Lomax, and Joseph T. Patterson May 1973 248 p refs
(Contract DAAB07-71-C-0244; DA Proj. 1S6-62705-A-056)
(AD-764259; ECOM-0244-2-71; Rept-010348-2; IR-2) Avail: NTIS CSCL 09/1

A theoretical and experimental investigation of noise in avalanche transit-time devices has been carried out. The main emphasis has been on oscillator noise which is characterized by AM and FM noise spectra. Detailed calculations have been carried out for determining the AM and FM noise in avalanche transit-time oscillators as a function of various operating parameters of the device, the diode structure and material properties as well as the external circuit. The theoretical results are compared with experimental results which were obtained for various operating points. These results lead to an improved understanding of noise in oscillators utilizing these devices. The effect of oscillator noise on the signal-to-noise ratio of a self-mixing avalanche-diode oscillator used in a short-range Doppler radar is determined. AM noise is found to be the limiting factor with the contribution of video noise becoming important at low frequencies and small signal levels. (Modified author abstract)
GRA

N73-31189# Rome Air Development Center, Griffiss AFB, N.Y.
TEMPORAL-SPATIAL COMPRESSION ANTENNAS
Paul VanEtten Jun. 1973 51 p refs
(AD-764354; RADC-TR-73-179) Avail: NTIS CSCL 09/5

The idea of using an antenna as a pulse compression network is presented employing the natural dispersion inherent in some broadband antennas. It is shown that the power densities resulting from such antennas are increased by the time-bandwidth product of the antenna over its CW power density. Experimental measurements have been performed on two (2) antennas to determine their transfer functions. Both the circular-polarized cavity-backed spiral and the linearly- polarized pyramid log periodic antennas have excellent chirp transfer functions and the results are given. Author (GRA)

N73-31190# Bendix Corp., Sidney, N.Y. Electrical Components Div.
RELIABLE INTEGRATED WIRE TERMINATION DEVICES Final Report
Donald L. Pfendler and Donald H. Gould Jul. 1973 203 p
(Contract DAAB07-71-C-0090; DA Proj. 1F1-62203-A-119)
(AD-764248; ECOM-0090-71-F) Avail: NTIS CSCL 09/1

The final report covers an investigation into the design and evaluation of a single wire termination system capable of interconnection to various existing designs of multi-contact connectors. The devices using this termination system were to be capable of assembly and maintenance with a common tool. In addition, the devices were to reliably withstand the environmental conditions encountered by ground and airborne Army equipment with emphasis on improvement for Army aircraft. The concept designed and evaluated makes waterproof connectors having crimp removable MS27491 series contacts practical to produce. (Modified author abstract) GRA

N73-31191# Army Electronics Command, Fort Monmouth, N.J.
CHARACTERIZATION OF EMP PROTECTION DEVICES
G. G. Davidson and E. T. Hunter Jul. 1973 53 p
(DA Proj. 1S6-62705-A-440)
(AD-763886; ECOM-4128) Avail: NTIS CSCL 09/5

Since late 1969, a technique based on time domain reflectometry (TDR) to measure the fast switching and shunting capability of EMP protective devices has been used. This technique allows the devices to be characterized in their actual working condition--inserted in the cable line--without the perturbing influence of voltage and current probes. The report starts with the basic line theory and develops an understanding of the effect of shunt devices and the measurement of such effects using TDR. This section is fairly lengthy; however, a good background is essential for the understanding of measurements made with this technique. In addition to the measurement technique itself, a special pulse generator was developed to provide the necessary pulse into 50 ohm lines. This pulse source is described along with the basic measurement procedure. Specific techniques and data are shown for a variety of shunt protective devices.
Author (GRA)

N73-31192# Auburn Univ., Ala. Dept. of Physics.
SECOND BREAKDOWN IN THE PRESENCE OF INTENSE IONIZING RADIATION AND RELATED STUDIES Final Report
Duane H. Pontius, Wallace B. Smith, Aradhana Baruah, and Paul P. Budenstein 18 Jun. 1973 96 p refs
(Contract DAAH01-72-C-0894)
(AD-763951) Avail: NTIS CSCL 09/1

The role of intense pulses of ionizing radiation on the second breakdown transition is investigated using silicon-on-sapphire p(-) - n - p(-) diodes. Superimposed on a high amplitude current pulse is a pulse of intense ionizing radiation from a Q-switched neodymium-glass laser. Photocurrents proportional to the radiation intensity are observed all the way to the threshold of damage by laser irradiation alone. The photocurrents do not affect the second breakdown transition until the intensity of the laser beam is close to that for destruction by the laser alone. In a study of the damage produced by the laser beam alone, no heating effects are detectable right up to the damage threshold. Damage occurs by vaporization of the silicon; the absorption coefficient of silicon changes within a few nanoseconds by more than a factor of 10 at the damage threshold. The mechanism of absorption is unknown. Second breakdown behavior is described in SOS diodes using double pulse excitation. Second breakdown in thin film MOSFET devices is described for several device geometries. Other studies include filamentation in plane silicon films, dynamic temperature measurements on SOS diodes, annealing of second breakdown damage, and microstructure of bulk transistors. (Modified author abstract) GRA

N73-31193# Microwave Associates, Inc., Burlington, Mass.
RELIABILITY OF HIGH FIELD SEMICONDUCTOR DEVICES Interim Report, 1 Apr. - 30 Sep. 1972
John L. Heaton and T. B. Ramachandran Jul. 1973 96 p
(Contract DAAB07-72-C-0101; DA Proj. 1S6-62705-A-056)
(AD-763929; ECOM-0101-72-I) Avail: NTIS CSCL 09/1

The report describes the results of a continuing program of investigation concerning the reliability and failure modes of gallium arsenide Gunn, and IMPATT diodes and silicon IMPATT diodes. Data is presented concerning the burn-out distribution in time and parameter change of 553 Gunn diodes placed on high temperature dc burn-in. The results of Gunn diode switching transient reliability tests and long term dc burn-in data are also reported. Temperature measurement data on operating gallium arsenide Gunn and IMPATT diodes obtained using an infrared radiometer are presented. Author (GRA)

N73-31194# Army Missile Command, Redstone Arsenal, Ala.
THERMAL RESPONSE OF POWER TRANSISTORS
Dallas L. Thurman 1 Jun. 1973 117 p refs
(AD-763903; RL-73-4) Avail: NTIS CSCL 09/1

The report is a study of the thermal effects on planar epitaxial silicon power transistors. The primary objectives considered are power dissipation and junction temperature of the device. A nonlinear digital program model is developed with temperature being the dynamic factor. Theoretical techniques are developed to describe I sub(CBO), forward, and saturation region of operation, with respect to the temperature variable. Throughout the study, temperature has significant effects upon the operation of the silicon power transistor. Author (GRA)

N73-31195# Army Electronics Command, Fort Monmouth, N.J.
UTILIZATION AS RF-ANTENNAS OF LIVE AND OF LIFELESS STRUCTURES IN NATURAL AND IN MAN MADE JUNGLES
Kurt Ikrath, Kenneth J. Murphy, and William Kennebeck Jun. 1973 82 p refs
(DA Proj. 1S6-62701-A-448)
(AD-763887; ECOM-4133) Avail: NTIS CSCL 09/5

Natural forest trees, man-planted shade trees, metal lantern poles and building structures were used as efficient HF radio antennas with the aid of Hybrid Electromagnetic Antenna Couplers (HEMAC's). The performance of live trees and of inanimate metal structures as antennas is compared with the performance of conventional HF whip and dipole antennas. Similar practical data are given on the LF radio signal emission capabilities of hugh steel-concrete buildings and on LF radio signal diffusion via electrical power and water distribution systems in suburban areas. Author (GRA)

N73-31196# Harry Diamond Labs., Washington, D.C.
CABLE DRIVER TECHNIQUES AND HARDWARE DEVELOPED DURING THE PERSHING CABLE/CONNECTOR PROGRAM Final Technical Report
Robert F. Gray Feb. 1973 31 p
(DA Proj. 1B0-62104-A-088; HDL Proj. E032E2)
(AD-764236; HDL-TR-1614) Avail: NTIS CSCL 09/1

Cable Driver Testing is a technique widely used in the evaluation of the shielding effectiveness of exterior cable shields. The cable driver is used to create a current on the exterior shield of the cable. Then, by comparing the ratio of the internal current to the external current with the current ratios obtained from other cables or test conditions the relative shielding characteristics of a particular cable can be determied. In order to complete the Pershing cable/connector program, new cable driver techniques and hardware had to be developed including a portable driver which could be used to test fielded cables. The electrical characteristics and general design of all the drivers covered in the report are very similar. However, due to the physical differences in the test items and different sensitivity and resolution requirements in the instrumentation, no one driver setup could be used for all tests. Also, there was a natural refinement of the testing techniques as the program progressed. These modifications and improvements in the cable driver testing technique are described in the report. Author (GRA)

N73-31197# Army Electronics Command, Fort Monmouth, N.J.
SURFACE WAVE DEVICES, TECHNIQUES AND APPLICATIONS
T. J. Klein and E. A. Mariani Jun. 1973 34 p refs
(DA Proj. 1S6-62701-A-327; DA Proj. 1S6-62705-A-057)
(AD-763881; ECOM-4124) Avail: NTIS CSCL 09/1

Acoustic surface wave technology, a relatively new electronics discipline, has made significant progress in recent years and stands ready to be implemented in a variety of applications. The capabilities of surface wave devices as signal processors for spread spectrum communications systems are described. Also, a general discussion concerning the background and advantages of these devices is presented with particular attention given to phase-coded matched filters. Author (GRA)

N73-31198# Watkins-Johnson Co., Palo Alto, Calif.
TACTICAL MULTI-TUNED PRESELECTOR Final Technical Report, 20 Sep. 1971 - 20 Dec. 1972
Robert E. Tokheim Apr. 1973 152 p refs
(Contract F30602-71-C-0295)
(AD-762517; W-J-73-5962R15; RADC-TR-73-101) Avail: NTIS CSCL 09/5

A study was made primarily of nonreciprocal YIG filter preselectors for the purpose of providing a suitable front-end for frequency-selective communications receivers. It was shown that fixed-tuned miniaturized nonreciprocal YIG preselectors can be arranged in a YIG filter bank (multi-channel) configuration with narrow bandwidths, low insertion loss, high directivity, nanosecond switching, and frequency-hopping rates in the MHz range. Accurate mathematical models were developed for analyzing the YIG preselector and these were utilized in a computer design program for the reciprocal and tri-loop filter configurations. Feasibility of achieving bandwidths within the 0.1 to 50 MHz range with low insertion loss was demonstrated. (Modified author abstract) GRA

N73-31199# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OTHER SOURCES OF MOTION-INDUCED NOISE IN A TOWED ELF H-FIELD ANTENNA
Michael L. Burrows 25 May 1973 50 p refs
(Contract F19628-73-C-0002; AF Proj. 1508A)
(AD-762936; TN-1973-21; ESD-TR-73-148) Avail: NTIS CSCL 09/5

Other modes of cable vibration are compared, in their production of motion-induced noise, with the pure flexing mode. It is shown that the other modes are either negligible or can easily be made so. Earlier work of Pelios on the same problem is extended to yield an explicit quantitative result which is consistent with this conclusion. To effect the comparison, the magnitude at the cable surface of the shear fluctuations relative to the pressure fluctuations must be evaluated. This is done using the theory of turbulent boundary layers and also, separately, by using strain-gage measurements taken on a towed cable. Both methods produce the same result. The engineering theory used for the analysis is compared with a theory using the exact equations of elasticity and found to be entirely adequate for the purpose. (Modified author abstract) GRA

N73-31081 Joint Publications Research Service, Arlington, Va.
SAWTOOTH VOLTAGE GENERATOR WITH SHORT RETURN TIME
K. V. Barinov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 267-271 ref Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 244-248 (For availability see N73-31054 22-07)

N73-31082 Joint Publications Research Service, Arlington, Va.
THREE CENTIMETER RING BALANCED MODULATOR
Yu. A. Ostroumov and A. M. Klementyev *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 272-284 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 249-262 (For availability see N73-31054 22-07)

N73-31861* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NASA/JPL DEEP SPACE NETWORK 64 METER DIAMETER

ANTENNA DUAL FREQUENCY FEED SYSTEM
P. D. Potter *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 23-26 ref (For availability see N73-31858 22-34)
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10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-31200 Johns Hopkins Univ., Baltimore, Md.
DIGITAL CIRCUIT OPTIMIZATION BY TIME MULTIPLEXING COMPONENT DEVICES Ph.D. Thesis
Edmund Freeman 1972 234 p
Avail: Univ. Microfilms Order No. 73-12136

Time multiplexing is studied in digital circuits. The methods described here can be used to treat arbitrary digital circuits. Procedures are presented which find low cost digital circuits by taking advantage of the possibility of using time multiplexing. The low cost digital circuits compute the same output functions as an original circuit, although they require a longer time to do so. Circuits which are synthesized from an original circuit, called multiplexed versions, are composed of the same kinds of devices as the original circuit. A device in a multiplexed version may perform, in turn, the computations of several devices of the same kind in the original circuit. A heuristic procedure is presented for cases where original circuits become too large. Details of the models and algorithms are presented and discussed.
Dissert. Abstr.

N73-31201 Michigan Univ., Ann Arbor.
THE ELECTROMAGNETIC RADIATION FROM SIMPLE SOURCES IN THE PRESENCE OF A HOMOGENEOUS DIELECTRIC SPHERE Ph.D. Thesis
V. Bradford Mason 1972 147 p
Avail: Univ. Microfilms Order No. 73-11201

The effect of a homogeneous dielectric sphere on the electromagnetic radiation from simple sources is treated as a boundary value problem, and the solution is obtained by the technique of dyadic Green's functions. Exact representations of the electric fields in the various regions due to a source located inside, or on the surface of a dielectric sphere are formulated. Particular attention is given to the effect of sphere size, source location, dielectric constant, and dielectric loss on the radiation patterns and directivity of small spheres (5 wavelengths in diameter) using the Huygens, source excitation. The computed results are found to closely agree with those measured for waveguide-excited plexiglas spheres. Dissert. Abstr.

N73-31202*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIGITAL PHASE LOCKED LOOP Patent Application
Rodger A. Cliff, inventor (to NASA) Filed 20 Aug. 1973 23 p (NASA-Case-GSC-11623-1; US-Patent-Appl-SN-389929) Avail: NTIS HC $3.25 CSCL 09C

An all digital phase-locked loop is reported that derives an output signal from an accumulator output terminal. A phase detecting exclusive OR gate is fed by the loop digital input and output signals. The output of the phase detector is a bi-level digital signal having a duty cycle indicative of the relative phase of the input and output signals. The accumulator is incremented at a first rate in response to a first output level of the phase detector and at a second rate in response to a second output level of the phase detector. NASA

N73-31203# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
STUDIES OF THE DIELECTRIC PROPERTIES OF ICE GROWN FROM KCl SOLUTION
Norikazu Maeno 1973 48 p refs
(Contrib-1247) Avail: NTIS HC $4.50

Polycrystals and monocrystals of ice were grown from KCl solutions, and their dielectric properties were investigated as functions of frequency, temperature, concentration, grain size, and thickness of each specimen. When the temperature was higher than the eutectic point of the KCl-H2O system (-10.7C) the presence of the liquid solution gave considerable effect on the dielectric properties of the polycrystalline KCl ice, showing extremely large values of dielectric constant and conductivity.
Author

N73-31204# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
STABILITY OF DOUBLE-LOOP SYSTEMS WITH DEAD TIME [STABILITAET ZWEIKREISIGER TOTZEITSYSTEME]
Ralph Luetzendorf 12 Jul. 1972 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-45) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 10.20 DM

The stability of feedback control systems with two feedback loops and inhibited with dead time was investigated. It is shown, under assumptions which are always satisfied in practice, that a two-loops dead-time system with several inputs is stable if and only if all transfer functions which have to be considered have no poles either on the imaginary axis or in the right half of the complex plane. This criterion, a second and third form is also derived, was deducted by means of the theory of complex functions and Laplace transform extending a method given in the literature for a single loop single deadtime control system with one input. The exact stability test, which is possible in part by use of the frequency response, is discussed. The determination of zeros of transcendent functions is not required. The inadmissibility of approximations is shown by an example. ESRO

N73-31205# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
SIMPLE INTEGRATED DIGITAL CIRCUIT WITH GUNN ELEMENTS [EINE EINFACHE INTEGRIERTE DIGITAL-SCHALTUNG MIT GUNNELEMENTEN]
K. Mause Feb. 1972 13 p refs In GERMAN; ENGLISH summary
(FTZ-A-62-TBR-3) Avail: NTIS HC $3.00

The structure and electrical performance of a simple GaAs digital integrated circuit using Gunn devices for PCM application, capable of operating up to 2 Gbits/s, are described. By employing Schottky barrier diodes, a directed transfer of domain pulses is achieved within the circuit, which is almost free of reactive effects. The fan-out of the circuit will be considerably improved by utilizing Gunn devices with Schottky barrier gates as additional control electrodes. ESRO

N73-31206# Texas Instruments, Inc., Dallas. Central Research Labs.
LIQUID CRYSTAL DISPLAY PANEL Quarterly Technical Report, 1 Jul. - 30 Nov. 1972
A. R. Kmetz Jul. 1973 34 p
(Contract DAAB07-72-C-0158)
(AD-763927, TI-08-73-16; ECOM-0158-72-2; QTR-2) Avail: NTIS CSCL 09/5

The objective of this program is to demonstrate the feasibility of developing an effective x-y addressed liquid crystal display by fabricating a three-inch square flat-panel liquid crystal display incorporating all addressing and drive circuitry for the display of an alphanumeric and vector-graphical information at a resolution of 30 lines per inch. The reflective display will be built directly on a silicon substrate containing an MOS random access memory with interface drivers. To eliminate chip-to-chip interconnections inside the display, the substrate will be a mosaic of four 1.7-inch square integrated circuit chips with exceptionally low circuit density. The detailed layout of the MOS circuitry for each quadrant of the flat-panel display has been completed. (Modified author abstract) GRA

N73-31859* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEVELOPMENT AND DEMONSTRATION OF HYBRID PROGRAMMABLE ATTITUDE CONTROL ELECTRONICS
L. S. Smith and E. H. Kopf, Jr. *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 1-10 refs (For availability see N73-31858 22-34)
CSCL 09C

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-31207*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CVT/PCS PHASE 1 INTEGRATED TESTING
Robert O. McBrayer and Jackie D. Steadman Jul. 1973 41 p
(NASA-TM-X-64770) Avail: NTIS HC $4.25 CSCL 14B

Five breadboard experiments representing three Sortie Lab experiment disciplines were installed in a payload carrier simulator. A description of the experiments and the payload carrier simulator was provided. An assessment of the experiment interface with the simulator and an assessment of the simulator experiment support systems were presented. The results indicate that a hardware integrator for each experiment is essential; a crew chief, or mission specialist, for systems management and experimenter liaison is a vital function; a payload specialist is a practical concept for experiment integration and operation; an integration fixture for a complex experiment is required to efficiently integrate the experiment and carrier; simultaneous experiment utilization of simulator systems caused unexpected problems in meeting individual experiment requirements; experimenter traffic inside the dual-floor simulator did not hamper experiment operations; and the requirement for zero-g operation will provide a significant design challenge for some experiments. Author

N73-31208# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
FOG SIMULATOR SYSTEM MODIFICATION Final Report
A. Sussman Jul. 1973 70 p
(Contract DOT-FA72WA-2912)
(FAA-RD-73-130) Avail: NTIS HC $5.50

Modifications are presented of a daytime fog simulator system. In order to improve its effectiveness to realistically simulate actual fog, several changes have been incorporated into the unit. The fog simulator system and the modifications to correct problem areas are presented in detail. Data and specifications for each film catagory are included. Acceptance test procedures are outlined and instructions are published for the operation of the ground checkout fixture. The results of the preliminary acceptance tests are favorable and within the specification tolerances. Author

N73-31209*# AiResearch Mfg. Co., Torrance, Calif.
DESIGN AND DEVELOPMENT OF LIQUID HYDROGEN MIXER UNIT Final Report
Robert W. Morgan, Kenneth Wuertz, and Robert R. Rudich [1973] 182 p refs
(Contract NAS3-11208)
(NASA-CR-120963) Avail: NTIS HC $11.25 CSCL 14B

A dc brushless motor driven mixer unit (a vaneaxial fan) was designed and evaluated for use in cryogenic fluids (liquids and gases). It was found to operate well in all fluids in which it was tested. The test fluids were liquid and gaseous helium, hydrogen in the liquid phase gas phase and mixtures of the two phases, and liquid nitrogen. It operated for over 100 hr at cryogenic temperatures without damage to the bearings and at the conclusion of testing the condition of the bearings was such that an operational life of 5000 hr appeared possible. The unit demonstrated that (with the brushless dc motor principle) useful pumping of cryogenic fluids could be accomplished with very small power inputs to the mixer motor. During test, the motor input power varied from approximately 0.5 W to 2.5 W, depending on fluid density. The high power input produced a mixer efficiency of over 49 percent. In an earlier program (see NASA Report CR-72365), a mixer using an ac induction motor demonstrated an efficiency of 17.7 percent under the same conditions, illustrating the advantage of the dc brushless motor driven unit. The mixer also demonstrated its ability to automatically vary speed as a function of the density of the fluid being pumped. This causes the unit to deliver higher volumetric flow rates as fluid density decreases. Author

N73-31210# Commissariat a l'Energie Atomique, Vaujours (France).
DEVELOPMENT AND PERFORMANCE OF A DOUBLE DIAPHRAGM SHOCK TUBE Ph.D. Thesis - Paris Univ.
J. C. Leboucher Feb. 1973 108 p refs In FRENCH
(CEA-R-4365) Avail: AEC Depository Library HC $7.50

The theoretical and experimental performance were compared, argon being used as the test gas. In this way, it was shown that shock waves having velocities as high as 15 km/s could be produced. Various diagnostic techniques were employed to measure the velocity of the wave front and its attenuation, as well as the thickness of the gas heated by the shock (expressed generally by the test time, at a given point). An estimation of the temperature and electron number density of the plasma behind the shock was effected spectroscopically. The experimental results obtained confirm theoretical predictions. It is shown that the velocity gain of T.C.D. 2 over a simple shock tube may be as high as 60%. Author (NSA)

N73-31211# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
PROGRAM CONTROL OF THE GERMAN CENTRAL GROUND STATION (Z-DBS), WEILHEIM-LICHTENAU
Walter Splechtna 20 Jun. 1972 31 p refs In GERMAN; ENGLISH summary
(Contract RFF-4017; RFF-4018)
(DLR-MITT-72-16) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 10,90 DM

Equipment design and operation for program control of the central German ground station are described. The task of the program control equipment is to initialize the switching operations necessary for a satellite pass and to control the antenna movements. The data flow to the equipment includes: world time, antenna position, and control signals from a punched tape. ESRO

N73-31212# Naval Ship Research and Development Center, Bethesda, Md. Ship Acoustics Dept.
THE ANECHOIC FLOW FACILITY: AERODYNAMIC CALIBRATION AND EVALUATION
Brian E. Bowers May 1973 46 p refs
(SF43452007)
(AD-763668; SAD-48E-1942) Avail: NTIS CSCL 14/2

Since May 1971, the new anechoic flow facility at the Naval Ship Research and Development Center has been undergoing periodic operational exercises and calibrations to determine the extent to which the facility may be used in the study of flow-induced noise. Some preliminary results are available with respect to both acoustical and aerodynamic calibrations. The purpose of this report is to evaluate the aerodynamic performance characteristics of the facility with regard to the established design specifications and to present some preliminary aerodynamic calibration data. (Modified author abstract) GRA

N73-31213# Army Construction Engineering Research Lab., Champaign, Ill.
AIRCRAFT-PAVEMENT INTERACTION STUDIES, PHASE 1: A FINITE-ELEMENT MODEL OF A JOINTED CONCRETE PAVEMENT ON A NON-LINEAR VISCOUS SUBGRADE (DYNAMIC INTERACTION OF AIRCRAFT-PAVEMENT SYSTEMS) Preliminary Report, Jul. 1971 - Jul. 1972
Arthur C. Eberhardt Jun. 1973 31 p refs
(DA Proj. 4A6-64717-D-895)
(AD-764243; CERL-PR-S-19) Avail: NTIS CSCL 01/5

The report describes a finite-element procedure for analyzing multilayered concrete airfield pavements. An equivalent plate theory is used to account for the increased stiffness provided by a stabilized base or a structural overlay. The stiffness is also adjusted to provide for the effects of various bond levels developed between the pavement layers. The finite-element pavement model was developed to aid the study of airfield pavement interaction and especially to help analyze surface deformations resulting from multi-wheel aircraft loads. Pavement joints are given finite dimensions and treated as separate entities to permit more

accurate determination of stress at an edge in a jointed pavement. Subsoil material can be modeled as a linear elastic, non-linear, or non-linear viscous material. (Modified author abstract) GRA

N73-31214# Purdue Univ., Lafayette, Ind.
APPLICATION OF ENERGY CONCEPTS TO THE PERFORMANCE OF AIRFIELD PAVEMENTS Technical Report, Nov. 1970 - Feb. 1973
William H. Highter and M. E. Harr Kirtland AFB, N. Mex. Jun. 1973 174 p refs
(Contract F29601-71-C-0014; AF Proj. 683M)
(AD-763118; AFWL-TR-72-225) Avail: NTIS CSCL 01/5

Pavement engineers have not been able to predict the performance of pavement systems prior to actual construction and operational utilization. A solution to this problem was obtained by verifying the following hypothesis developed from energy concepts: A functional relationship exists between the cumulative energy as measured by cumulative peak deflections imparted to a given pavement system and the condition of that system. Because of the paucity of airfield condition and deflection data, indirect means has to be used to test the working hypothesis for airfield pavements. Traffic records and construction histories for two Air Force Bases were analyzed, and indicated a threshold cumulative total peak deflection at which cracking develops in airfield pavements. (Modified author abstract) GRA

N73-31215# Army Construction Engineering Research Lab., Champaign, Ill.
PROCEEDINGS, ALLERTON PARK CONFERENCE ON SYSTEMS APPROACH TO AIRFIELD PAVEMENTS (RATIONAL PAVEMENT DESIGN)
R. W. Woodhead and R. H. Wortman Jun. 1973 511 p refs Conf. held at Allerton Park, Ill., 23-26 Mar. 1970
(DA Proj. 4A0-62112-A-891)
(AD-763212; CERL-TR-P-5) Avail: NTIS CSCL 01/5

Prior to the 1970's, design methodology for airfield pavements represented empirical and theoretical extrapolation of pavement strength based on structural considerations and slab support, with judgment factors to compensate for lack of technology and differences in user requirements. With the great weight range and variations in ground control characteristics of modern aircraft, this combination of judgment and theory no longer adequately serves the pavement designer in meeting the user needs. New approaches and concepts are needed to bring pavement design up to the level of sophistication of aircraft design. Design problems must be related to needs of a wide range of users over extended periods of time and service conditions. (Modified author abstract) GRA

N73-31216# Arizona State Univ., Tempe. School of Engineering.
A SUMMARY OF OPTIMIZATION TECHNIQUES THAT CAN BE APPLIED TO SUSPENSION SYSTEM DESIGN Final Report
J. Karl Hedrick Mar. 1973 42 p refs
(Contract DOT-OS-335)
(PB-220553/2; DOT-TSC-OST-73-9) Avail: NTIS HC $3.00 CSCL 13F

Summaries are presented of the analytic techniques available for three levitated vehicle suspension optimization problems; optimization of passive elements for fixed configuration; optimization of a free passive configuration; optimization of a free active configuration. The techniques are applied to a heave dynanic model which includes gravity forces, random aerodynamic forces and random guideways making use of penalty functions which include vehicle acceleration, suspension displacement, gap variation, power requirements. GRA

N73-31217# Tennessee State Planning Commission, Nashville.
AIRPORT ENVIRONS PLAN, JACKSON, TENNESSEE Final Report
Jun. 1973 70 p Sponsored by HUD
(PB-221129; TN-JACN-73-1006) Avail: NTIS HC $5.50 CSCL 01E

The report presents a guide by which the governmental leaders of Jackson and Madison County can utilize in assuring that the McKellar Airport and the community surrounding it will always be compatible with each other. The report is presented in the following four sections: (1) goals and objectives, (2) basic background data, (3) the environs plan, and (4) plan implementation. Also included is an environmental assessment statement as required by the Department of Housing and Urban Development. A major highlight of the report is the presentation of a schematic design for a planned air industrial park proposed to be located adjacent to the airport which integrates the use of several modes of transportation. GRA

N73-31218# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.
ANALYSIS OF THE ABILITY OF A LASER PROFILOMETER SYSTEM TO EVALUATE UNPREPARED LANDING SITES Final Report
Lewis E. Link, Jr. May 1973 111 p refs
(DA Proj. 1V0-21701-A-047)
(AD-763180; AEWES-Misc-Paper-M-73-7) Avail: NTIS CSCL 01/5

A study was made to determine the feasibility of using an airborne laser profilometer system to rapidly appraise selected unprepared landing sites. Evaluation of terrain roughness was made in terms of microrelief, slope, and obstructions. Laser profilometer data were collected at 12 test areas that provided variations in surface geometry, vegetation cover, and other natural and man-made features. (Modified author abstract) GRA

N73-31855 National Research Council of Canada, Ottawa (Ontario). Flight Research Lab.
A SHORT DESCRIPTION OF THE NAE AIRBORNE SIMULATOR FEEL SYSTEM
W. E. B. Roderick *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 13-20 (For availability see N73-31853 22-34)

N73-31857 National Research Council of Canada, Ottawa (Ontario). Gas Dynamics Lab.
EXPERIENCE WITH THE NRC 10 FT x 20 FT V/STOL PROPULSION TUNNEL, SOME PRACTICAL ASPECTS OF V/STOL ENGINE MODEL TESTING
R. A. Tyler and R. G. Williamson *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 34-59 refs (For availability see N73-31853 22-34)

N73-31860* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INDUCED SHOCK PULSE TESTING BY TRANSIENT WAVEFORM CONTROL
B. K. Kim *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 11-22 refs (For availability see N73-31858 22-34)
CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-31219 Catholic Univ. of America, Washington, D.C.
A STUDY OF THE EFFECT OF PRESSURE GRADIENT ON THE EDDY VISCOSITY AND MIXING LENGTH FOR INCOMPRESSIBLE EQUILIBRIUM TURBULENT BOUNDARY LAYERS Ph.D. Thesis
Walter James Glowacki 1973 173 p
Avail: Univ. Microfilms Order No. 73-12883

An attempt was made to improve the accuracy of turbulent boundary layer calculations by finding an expression for the turbulent shear stress which more accurately accounts for the effect of the freestream pressure gradient. Shear stress, eddy viscosity, and mixing length distributions corresponding to a number of turbulent boundary layers were calculated by substituting experimentally measured velocity profile data into the governing equations expressing conservation of mass and momentum. Distributions were obtained for five incompressible, two-dimensional boundary layers which have constant values of

the pressure gradient parameter, beta. The five equilibrium flows cover the range from moderate adverse pressure gradient to strong favorable pressure gradient. Where comparison is possible, the calculated distributions agree quite well with measured ones. Dissert. Abstr.

N73-31220 Michigan Univ., Ann Arbor.
EXPERIMENTAL OBSERVATIONS AND NUMERICAL SIMULATION OF THE WEISSENBERG CLIMBING EFFECT Ph.D. Thesis
Lilan Lap-Yun Chan 1972 271 p
Avail: Univ. Microfilms Order No. 73-11069

Experimental and theoretical aspects of the Weissenberg climbing effect are considered together in an attempt to arrive at a detailed explanation of the actual mechanism involved. Free-surface shape and velocity profiles in flow between coaxial, rotating cylinders are determined experimentally for both Newtonian and viscoelastic fluids. A numerical simulation of the phenomenon is carried out. Stroboscopic photographs of the PVC tracer particles are taken in the flow visualization. The use of the Newtonian glycerol verifies the capabilities of the apparatus. Detailed measurement of the velocity field and the surface shape at various rotational speeds of the inner cylinder is conducted on a viscoelastic polymer solution, a 0.526 wt.% of Polyacrylamide in a 46:54 water-glycerol mixture. In addition, the surface shape is investigated with the following systems: a 1.5 wt.% solution of carboxymethyl cellulose in water, a 1.4 wt.% solution of hydroxyethyl cellulose in water, and a 1.5 wt.% polyacrylamide solution in a 50:50 mixture of water and glycerol.
Dissert. Abstr.

N73-31221 Illinois Inst. of Tech., Chicago.
CALCULATION OF THE FREE TURBULENT MIXING INTERACTION APPROACH Ph.D. Thesis
Thomas Allan Morel 1972 123 p
Avail: Univ. Microfilms Order No. 73-12223

The applicability of the interaction hypothesis of Bradshaw to turbulent free shear flows was investigated. According to the hypothesis a flow with a velocity extremum may be considered to consist of two interacting shear layers. The hypothesis leads to a new relation between the shear stress and the turbulent kinetic energy, needed for closure of the kinetic energy equation. The usual restriction that the shear stress vanishes at the velocity extremum is removed. The flows considered are two-dimensional, at high Reynolds numbers and at low Mach numbers. The approach is based on the kinetic energy equation for the length scale of turbulence. The governing equations of the compressible flows were simplified by making the restriction to low Mach numbers, and the range of applicability of the simplifying assumptions is discussed. Dissert. Abstr.

N73-31222 Illinois Inst. of Tech., Chicago.
ON OBSTACLE GENERATED SECONDARY FLOWS IN LAMINAR BOUNDARY LAYERS AND TRANSITION TO TURBULENCE Ph.D. Thesis
Renny Stuart Norman 1972 166 p
Avail: Univ. Microfilms Order No. 73-12225

The basic features of secondary flows around and downstream of protuberances in laminar boundary layers and the conditions under which these flows lead to transition to turbulence were investigated. Three vortex systems were defined and qualitatively described: the horseshoe vortex system, spiral-trailing vortex system and the vortex system resulting from the instability of the top shear layer. The interactions of these systems and their influence on the transition process (formation of a turbulent wedge) were discussed. The instability of the top shear was documented to consist of an exponential amplification process followed by a nonlinear limiting process. Once the limit amplitude has been reached, the roll-up vortices rose to the top of the boundary layer and moved uniformly downstream, decaying in the process. The amplification characteristics were readily altered by changing the amplitude and frequency of acoustic excitation.
Dissert. Abstr.

N73-31223 Washington Univ., St. Louis, Mo.
THE FLOW OF CONCENTRATED SUSPENSIONS IN CIRCULAR TUBES Ph.D. Thesis
John Gerard Manda 1972 250 p
Avail: Univ. Microfilms Order No. 73-11817

The motion and distribution of particles in steady, tube flows of suspensions of neutrally buoyant, rigid spheres have been investigated experimentally. By means of bi-plane motion photography, the three-dimensional trajectories of individual particles were recorded. Simultaneous measurements of pressure drop and volumetric flow were made over selected ranges of particle concentration (10 to 40%), the ratio of tube-to-particle diameter (5 to 39), and the tube-flow Reynolds number (0.1 to 1). From the film records, radial profiles of average axial speed and volume concentration of the particles were determined. Apparent viscosities were calculated from the pressure-drop and flow data. Dissert. Abstr.

N73-31224 Notre Dame Univ., Ind.
ENERGY TRANSFER IN A MODEL OF TURBULENCE Ph.D. Thesis
Shih-li Lai 1972 121 p
Avail: Univ. Microfilms Order No. 73-12075

Nonlinear interactions between two groups of functions analogous to Fourier transforms of the Navier-Stokes equation with average wave number Kf and Kg, and with random orientations were studied statistically. Energy is injected into one group and removed from the other so that each group keeps a constant energy. The computer then determines the rate of energy transfer from one group to the other, as well as the rate of energy transfer within each triplet of functions. Direct-interaction approximation was applied to the model. Two nonlinear integro-differential equations which govern the autocorrelation functions H and h are obtained with the assumption that the average impulse-response functions are identical to the autocorrelation functions. Comparisons between the numerical experiments and the direct-interaction approximation show good agreement in the regime where transfer coefficient sigma is small. Dissert. Abstr.

N73-31225 Michigan Univ., Ann Arbor.
DEPOSITION OF PARTICLES IN A TURBULENT SLOT FLOW Ph.D. Thesis
Herbert Hotaling Dobbs 1972 322 p
Avail: Univ. Microfilms Order No. 73-11091

The mechanism and extent of deposition of 0.1 to 15 micron particles out of a turbulent slot flow onto the slot walls is investigated. The application of the phenomenon to the design of a practical self cleaning air filter is considered. Both one- and two-dimensional analyses of the problem are presented. Experimental work and data is given for the former case. The experimental problem is discussed for the latter. In the one-dimensional experimental work measurements were made of the particle concentration changes in a flow passing through slots of different lengths for six particle sizes from 0.35 micron to 4.50 micron over a range of Reynolds numbers from 500 to 12,000. Sampling probes and a light scattering type particle counter were used with a liquid aerosol of dibutyl phthalate. The experimental results show excellent correlation with the one-dimensional deposition theory. Dissert. Abstr.

N73-31226 Illinois Inst. of Tech., Chicago.
STARTING VORTEX, SEPARATION BUBBLES AND STALL: A NUMERICAL STUDY OF LAMINAR UNSTEADY FLOW AROUND AN AIRFOIL Ph.D. Thesis
Unmeel B. Mehta 1972 270 p
Avail: Univ. Microfilms Order No. 73-12222

The stalling characteristics of an airfoil in a viscous incompressible fluid are investigated. The behavior of the time dependent laminar flow structure, force evolution and vortical formation is determined. The details of flow past a nine per cent thick symmetric airfoil at 15 deg angle of attack with R = 1000. are studied. The governing equations in terms of vorticity and stream function are solved utilizing an implicit finite difference scheme and point successive relaxation procedure. The development of the impulsively started flow, the initial generation of circulation and the structure of the starting vortex are investigated. Dissert. Abstr.

N73-31227 Catholic Univ. of America, Washington, D.C.
ANALYSIS OF COMPRESSIBLE THREE DIMENSIONAL TURBULENT FLOW OVER A YAWED CONE Ph.D. Thesis

A. Robin Mowlem 1973 176 p
Avail: Univ. Microfilms Order No. 73-12467

An analysis is made of compressible turbulent flow over a yawed cone for adiabatic and cold wall conditions. An integral method is developed expressing the three-dimensional boundary layer equations in terms of streamline coordinates making it possible to apply established two-dimensional relationships in the problem solution. The three governing partial differential equations - the streamwise and crossflow momentum equations and the entrainment equation - are reduced to ordinary differential equations and numerically integrated. The energy equation is used to modify the prediction of the surface heat transfer distribution for the effect of the circumferential pressure gradient. On the windward meridian, the differential equations reduce to non-linear algebraic equations providing the initial conditions for a general solution from the attachment line to the point of minimum pressure. Predictions are made for flow parameters such as the skin friction coefficient, the boundary layer thickness, and the surface heat transfer distribution. These predictions are well confirmed by comparison with experimental data. A feature of the solution method is the avoidance of the small crossflow assumption usually found in previous analyses. Dissert. Abstr.

N73-31228 Engineering Sciences Data Unit, London (England).
AEROFOILS HAVING A SPECIFIED FORM OF UPPER SURFACE PRESSURE DISTRIBUTION: DETAILS AND COMMENTS ON DESIGN
Dec. 1971 23 p refs Supersedes ESDU-67010 Sponsored by Min. of Defence and Roy. Aeron. Soc.
(ESDU-71020; ESDU-67010) Copyright. Avail: Issuing Activity

The aerodynamic configuration of a series of airfoils used in parametric studies of drag-rise Mach number are discussed. The particular form of upper surface pressure distribution over the airfoil under various flow conditions is described. The influence of the principal design variables on the geometrical shape of the cambered airfoils to obtain the specified upper surface pressure distribution is discussed. Author

N73-31229 Engineering Sciences Data Unit, London (England).
DRAG-RISE MACH NUMBER OF AEROFOILS HAVING A SPECIFIED FORM OF UPPER SURFACE PRESSURE DISTRIBUTION: CHARTS AND COMMENTS ON DESIGN
Dec. 1971 53 p refs Supersedes ESDU-67009 Sponsored by Min. of Defence and Roy. Aeron. Sci.
(ESDU-71019; ESDU-67009) Copyright. Avail: Issuing Activity

The drag-rise Mach number of airfoils with specified upper surface pressure distribution is analyzed. Charts for estimating the drag-rise Mach number as a function of the lift coefficient and the thickness to cord ratio for an infinite family of airfoils in viscous flow are presented. The derivation of charts, the accuracy, inherent limitations, and predictions of the principal charts in relation to those for alternative combinations of thickness and upper surface pressure distributions are discussed. Author

N73-31230 Engineering Sciences Data Unit, London (England).
A METHOD FOR ESTIMATING DRAG-RISE MACH NUMBER OF SMOOTH NONDUCTED AXISYMMETRIC BODIES AT ZERO INCIDENCE
Aug. 1971 24 p refs Sponsored by Min. of Defence and Roy. Aeron. Soc.
(ESDU-71008) Copyright. Avail: Issuing Activity

A method is given for estimating drag-rise Mach number of smooth, non-ducted, axisymmetric bodies at zero incidence without discontinuities in surface slope. The method is based on the observation in the limited number of experimental data available that shock-wave drag develops rapidly as shock waves form downstream of the axial location of the body maximum cross-sectional area. Analogy with the observed development of shock-wave drag on two-dimensional airfoils suggests that the drag-rise Mach number is that at which the shock, either on first being formed or on moving from an upstream station, first appears to the rear of this location. The problem of predicting drag-rise Mach number is thus reduced to that of predicting the free-stream Mach number at which the shock first appears at or downstream of this location and is achieved by applying a simple criterion to the calculated equivalent shock-free pressure distribution. Author

N73-31231 Connecticut Univ., Storrs.
ANALYTICAL AND EXPERIMENTAL STUDY OF SPATIALLY GROWING DISTURBANCES IN SHEAR LAYERS BETWEEN PARALLEL STREAMS Ph.D. Thesis
Bruce Virgil Johnson 1972 201 p
Avail: Univ. Microfilms Order No. 73-9808

The effects of translational velocity on the spatial growth of wavy disturbances in an inviscid shear layer were analytically studied using linearized theory. A series expansion was developed for regions near the zero wave number and for the neutral stability wave number and employed previously obtained temporal growth solutions to determine the spatial growth characteristics. An algebraic spatial growth stability solution was obtained for the linear velocity profile with an arbitrary translational velocity. Numerical solutions were obtained for the hyperbolic tangent velocity profile with several translational velocities and were compared with the previous temporal growth and spatial growth results. Dissert. Abstr.

N73-31232 Arizona Univ., Tucson.
ENTRY FLOW IN A CIRCULAR TUBE Ph.D. Thesis
John Anthony Bates 1972 254 p
Avail: Univ. Microfilms Order No. 73-12015

The steady laminar flow of a viscous fluid in the entrance region of a pipe is considered. The flow is axisymmetric and the fluid properties are constant. The method of solution is based on the method of matched asymptotic expansions from the higher order boundary layer theory as formulated by Van Dyke. Three different models, each with different inlet conditions, are investigated. These are a stream tube model, a uniform entry model with inlet vorticity, and a uniform irrotational entry model. For all three models, results are given at a Reynolds number of 75 and 1000. For the stream tube model, calculations are given for the physical quantities of primary interest (axial and radial velocities, pressure distribution and pressure drop increment). The effect of increasing Reynolds number is shown to be such as to suppress the upstream influence of the pipe, reduce the concavity and off-center peaks which occur in the velocity profiles, and reduce the radial velocity and pressure gradients. Dissert. Abstr.

N73-31233 Michigan Univ., Ann Arbor.
THE STRUCTURE OF THE REYNOLDS STRESS IN A TURBULENT BOUNDARY LAYER Ph.D. Thesis
Shui-Shong Lu 1972 129 p
Avail: Univ. Microfilms Order No. 73-11191

Experimental studies of the structure of the Reynolds stress in a turbulent boundary layer on a smooth wall with zero pressure gradient are reported. The technique of conditional sampling is employed to study the signal obtained from hot wire probes. The measurements of the mean time intervals and the durations of bursts and sweeps are attempted. In the conditional sampling method the velocity at the edge of the viscous sublayer is used as a detector for the bursts; and the signal is obtained from the x wire probe at various locations. From the measurements it is found that, when the velocity at the edge of the viscous sublayer becomes low and decreasing, a burst occurs. On the other hand, the sweep events occur when the velocity becomes large and increasing. Dissert. Abstr.

N73-31234 Michigan Univ., Ann Arbor.
HYDRODYNAMIC STABILITY OF CIRCULAR FIELDS AND REVOLVING FLUIDS Ph.D. Thesis
Cheng-I Yang 1972 81 p
Avail: Univ. Microfilms Order No. 73-11303

In part 1, the stability of an unsteady magnetic field is investigated in a conductive fluid between concentric cylinders. The magnetic Prandtl number of the conductive fluids is either very small or of order one. In the former case, the problem is solved by a singular perturbation technique and Floquet theory. In the latter case, it is assumed that the gap between cylinders is small. The Floquet theory and numerical integration are the basic tools of the study. Part 2 is a study of sufficient conditions for the stability of rotating flows and circular magnetic fields.

Miles' theorem (1961) and Howard's semi-circle theorem (1961) on the stability of stratified shear flows are extended to rotating flows with discontinuous swirl velocity. Some stronger sufficient conditions for stability are established, and the Strum-Liouville theorems provide the explanation of the possibility of multivalued wave number for neutral stability. Some sufficient conditions for the stability and instability of the perfect conductive fluids subjected to a transverse circular magnetic field are also studied. Dissert. Abstr.

N73-31235 California Univ., San Diego.
BOUNDARY AND SHEAR LAYERS IN ROTATING AND STRATIFIED FLUIDS Ph.D. Thesis
Yves Jean Francois Desaubies 1973 104 p
Avail: Univ. Microfilms Order No. 73-11975

The structure of different types of boundary and shear layers in rotating fluids is investigated. A shear layer due to bottom topography is studied in the homogeneous and stratified case, and the homogeneous boundary layer on the side wall of a circular cylinder is considered under fairly general boundary conditions. The linearized equations are solved asymptotically for small values of the Ekman number and of the stratification parameter. The layers are found to have a multiple scale structure and to fulfill two functions: closing the fluid circulation by returning fluid from one Ekman layer to the other and smoothing out the discontinuities between two velocity fields. Dissert. Abstr.

N73-31236# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
A STUDY OF SUPERSONIC CONICAL FLOW
Masahiro Kurosaki Jul. 1973 52 p refs
(ISAD-498O-Vol-38-No-9) Avail: NTIS HC $4.75

The supersonic conical flows without axial symmetry are studied by solving the exact conical flow equations numerically. The truncation method gives more accurate solutions than the previous studies in the region where the conical streamlines focus and the solution is apt to diverge on account of the vortical singularity. By use of the independent variables related to the stream functions the vortical layer is enlarged so that the flow quantities vary gradually across this layer and approach the values on the body surface asymptotically. The solutions of the flow past the circular cone shaped shocks and the circular cones inclined to the free stream are obtained with good accuracy by combining the solutions about the windward and the leeward symmetric lines obtained by the truncation method and the solution in the intermediate region between these symmetric lines by the finite difference method. The obtained flows satisfy within the error of 1% Bernoulli equation which can be used to examine the accuracy of the solutions. Author

N73-31237# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
AN EXACT SOLUTION ON THE PROPAGATION OF SMALL DISTURBANCES IN A RADIATING GREY GAS WITH ISOTROPIC SCATTERING
Masahide Murakami and Koichi Oshima Jun. 1973 32 p refs
(ISAS-494-Vol-38-No-5) Avail: NTIS HC $3.75

The problem of the one-dimensional propagation of small disturbances generated by the harmonic oscillation of a flat end wall, either in position or in temperature or both, is solved analytically using the normal-mode expansion method by Case. The effects of isotropic scattering on them are studied. An important finding is that the radiation induced wave exists even for the small Bouguer number under the influence of isotropic scattering. While it disappears with the decrease of the Bouguer number in the case without scattering effect. Some improvements on the solution, especially with respect to the propagation speed, are made by taking account of the time-dependent term of the radiative transport equation. Author

N73-31238*# Chrysler Corp., New Orleans, La. Space Div.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ROCKET PLUME SIMULATORS ON THE RADIAL AND LONGITUDINAL PRESSURE DISTRIBUTION OF A STING MOUNTED BODY OF REVOLUTION AT TRANSONIC MACH NUMBERS
James R. Burt, Jr. Redstone Arsenal, Ala. Army Missile Command Jul. 1973 393 p refs
(Contract NAS9-13247)
(NASA-CR-133916; AD-763904; RD-TR-74-21) Avail: NTIS HC $21.75 CSCL 16/4

Experimental aerodynamic investigations were conducted at the Cornell Aeronautical Laboratory (CAL) transonic wind tunnel to determine the effects of several rocket plume simulators on the pressure distribution of a body of revolution. These tests were conducted during September, 1971, on a sting supported model and were extensions of earlier (August 1970) tests on similar strut supported models. Therefore, these data can also be utilized to determine the effects of strut mounting on data validity. Local surface pressure data were recorded over an angle of attack range of plus or minus 2 degrees at Mach numbers of 0.9, 1.0 and 1.2 on a four-caliber tangent ogive nose with a cylindrical, a boattailed, and a flared afterbody and on the cylindrical afterbody with either a solid disc or a perpendic rlar (normal) jet flow acting as plume simulators. Author (GRA)

N73-31239# Lockheed Missiles and Space Co., Palo Alto, Calif.
CAVITATIONAL FLOW AROUND A PLATE IN A CHANNEL BY A GRAVITY FLUID STREAM
L. M. Kotliar and O. V. Troepolskaia [1973] 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 3, 1973 p 3-9
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The nonlinear problem of cavitational flow around a plate located on the horizontal bottom of a channel by a gravity fluid stream is investigated in an exact formulation when the gravity vector is directed perpendicularly to the channel walls. Two flow schemes, the Riabouchinsky and the Kuznetzov, are examined. Author

N73-31240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL STUDIES OF UNSTEADY TWO DIMENSIONAL SUBSONIC FLOWS USING THE ICE METHOD Ph.D. Thesis - Toledo Univ.
Paul R. Wieber Aug. 1973 246 p refs
(NASA-TM-X-68288) Avail: NTIS HC $14.50 CSCL 20D

A numerical program was developed to compute transient compressible and incompressible laminar flows in two dimensions with multicomponent mixing and chemical reaction. The algorithm used the Los Alamos Scientific Laboratory ICE (Implicit Continuous-Fluid Eulerian) method as its base. The program can compute both high and low speed compressible flows. The numerical program incorporating the stabilization techniques was quite successful in treating both old and new problems. Detailed calculations of coaxial flow very close to the entry plane were possible. The program treated complex flows such as the formation and downstream growth of a recirculation cell. An implicit solution of the species equation predicted mixing and reaction rates which compared favorably with the literature. Author

N73-31241*# Iowa State Univ. of Science and Technology, Ames. Dept. of Mechanical Engineering.
PREDICTION AND MEASUREMENT OF HEAT TRANSFER RATES FOR THE SHOCK-INDUCED UNSTEADY LAMINAR BOUNDARY LAYER ON A FLAT PLATE
William J. Cook Oct. 1972 112 p refs Sponsored by NASA
(NASA-CR-114582) Avail: NTIS HC $7.75 CSCL 20D

The unsteady laminar boundary layer induced by the flow-initiating shock wave passing over a flat plate mounted in a shock tube was theoretically and experimentally studied in terms of heat transfer rates to the plate for shock speeds ranging from 1.695 to 7.34 km/sec. The theory presented by Cook and Chapman for the shock-induced unsteady boundary layer on a plate is reviewed with emphasis on unsteady heat transfer. A method of measuring time-dependent heat-transfer rates using thin-film heat-flux gages and an associated data reduction technique are outlined in detail. Particular consideration is given to heat-flux measurement in short-duration ionized shocktube flows. Experimental unsteady plate heat transfer rates obtained in both air and nitrogen using thin-film heat-flux gages generally agree well with theoretical predictions. The experimental results indicate that the theory continues to predict the unsteady boundary

layer behavior after the shock wave leaves the trailing edge of the plate even though the theory is strictly applicable only for the time interval in which the shock remains on the plate.
Author

N73-31242# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
POPULATION DENSITY PROFILES IN A SOURCE FLOW EXPANSION OF A PARTIALLY IONIZED ARGON
A. Kimura, K. Teshima, and M. Nishida Sep. 1973 43 p
(C-37) Avail: NTIS HC $4.25

Profiles of population density of electronically excited states in a source flow expansion were computed for the case of a partially ionized argon for the purpose of predicting population density profiles along a centerline of a free jet expansion. In the present analysis, a ladder-climbing model was used for a collisional transition, and the excited states of argon atom were subdivided into four quasistates. The fourth state was taken to be a critical one in the entire region of the source flow expansion. It is considered that local thermal equilibrium is established between all the states higher than the critical state and that collisional and radiative transitions occur between the states lower than the critical state. The computed results show that the population density profiles of the second, third, and fourth excited states are similar for the case without the radiative transitions but that the population density profile of the first state is different from those of other excited states. In addition, the effect of the initial ratio of electron and atom temperatures on the population density profiles was investigated. Author

N73-31243# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
THE INFLUENCE OF INITIAL TURBULENCE ON THE PERFORMANCE OF ANNULAR DIFFUSERS
G. J. Williams and S. J. Stevens Feb. 1971 28 p refs Sponsored by Sci. Res. Council
(TT-7101) Avail: NTIS HC $3.50

Results are presented of an investigation into the influence of a high level of inlet turbulence on the performance of annular diffusers having center bodies of uniform diameter, and conically diverging outer walls. Methods used to generate inlet conditions are discussed along with instrumentation and experimental accuracy. Results indicate that, for the same inlet blockage fraction, increasing the level of turbulent mixing in the vicinity of the wall gives significant improvement in diffuser performance.
K.M.M.

N73-31244# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany).
FLOW CONDITIONS AT INLET AND EXIT OF A FLAT PLATE CASCADE AT SUPERSONIC VELOCITIES
H. J. Lichtfuss and H. Starken 1972 22 p refs Presented at the 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 June 1972
Avail: NTIS HC $3.25

The supersonic flow configurations possible at inlet and exit of an infinite two-dimensional straight cascade of flat plates between the flow behaviour at the inlet and exit of the cascade. The essential parameter is the axial component of the inlet and exit Mach number. At axial subsonic inlet Mach number a unique inlet flow angle exists whereas in the exit flow this condition occurs at axial supersonic Mach number. The limiting curves of the inlet flow angle at axial supersonic Mach numbers do exist also for the exit flow but at subsonic axial components.
Author

N73-31245*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace Engineering.
VORTEX AGE AS A WAKE TURBULENCE SCALING PARAMETER
J. R. Marshall and J. F. Marchman, III Aug. 1973 138 p refs
(Contract NAS1-10646)
(NASA-CR-132312; VPI-Aero-006) Avail: NTIS HC $9.00 CSCL 20D

Research which was conducted to determine the significance of vortex age as a scaling parameter in wake turbulence development and dissipation is reported. Tests were conducted at three angles of attack, three free stream speeds, and seven downstream positions from 2 to 30 chordlengths using an NACA 0012 wing and a five hole yawhead pitot probe. The end surface of the wing tip was flat. Speeds were selected to give a predetermined range of vortex ages. The complete velocity structure of the vortex was measured at each station and speed. The resulting plots of maximum tangential velocity and vortex core diameter versus downstream distance and vortex age indicate that vortex age is not a self sufficient scaling parameter. In addition to the expected effect of lift coefficient there is also a definite free stream speed influence at high wing angles of attack. The exact cause and nature of this effect is not fully understood, but it does not appear to be explainable in terms of Mach number or Reynolds number; however, the influence of tip edge shape on spanwise flow separation appears to be an important factor.
Author

N73-31246# Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.
THE INFLUENCE OF RETURN BENDS ON THE DOWNSTREAM PRESSURE DROP AND CONDENSATION HEAT TRANSFER IN TUBES
Donald P. Traviss 1 Oct. 1971 78 p refs
(Contract ASHRAE RP63)
(DSR-72591-75) Avail: NTIS HC $6.00

The influence of return bends on the downstream pressure drop and heat transfer coefficient of condensing refrigerant R-12 was studied experimentally. Flow patterns in glass return bends of 1/2 to 1 in. radius and 0.315 in. I. D. were examined visually and photographically using a high frequency xenon light source. Local pressure drop and heat transfer measurements were made along a horizontal 14 1/2 ft. test section immediately following the return bend. The refrigerant mass flux ranged from 1.32 times 100,000 to 4.58 times 100,000 pounds per hour-foot squared, saturation temperature from 90 to 107 F. and return bend quality from 0.24 to 1.0. The pressure drop and heat transfer data were compared to previous data for condensation without return bends. Effects on the downstream pressure drop and heat transfer were found to be small, if not negligible.
Author

N73-31247*# Rocketdyne, Canoga Park, Calif.
DROPLET BREAKUP IN ACCELERATING GAS FLOWS. PART 1: PRIMARY ATOMIZATION
L. J. Zajac Oct. 1973 40 p refs
(Contract NAS3-14371)
(NASA-CR-134478; R-9337-1-Pt-1) Avail: NTIS HC $4.00 CSCL 20D

An experimental study of the effects of an accelerating gas flow on the atomization characteristics of liquid sprays was conducted. The sprays were produced by impinging two liquid jets. The liquid was molten wax, while the gas was nitrogen. The use of molten wax allowed for a quantitative measure of the resulting dropsize distribution. The effects of the accelerating gas flow on the formation of the spray were examined. The results of this study indicate that the parameters that most affect the resulting dropsize are the injector parameters of orifice diameter and injection velocity, the maximum gas velocity, and the distance from the injector face at which the maximum gas velocity is attained. Empirical correlations for both the mass median dropsize and the dropsize distribution are presented. These correlations can be readily incorporated into existing computer codes for the purpose of calculating rocket engine combustion performance.
Author

N73-31248*# Rocketdyne, Canoga Park, Calif.
DROPLET BREAKUP IN ACCELERATING GAS FLOWS. PART 2: SECONDARY ATOMIZATION
L. J. Zajc Oct. 1973 61 p refs
(Contract NAS3-14371)
(NASA-CR-134479; R-9337-2-Pt-2) Avail: NTIS HC $5.25 CSCL 20D

An experimental investigation to determine the effects of an accelerating gas flow on the atomization characteristics of liquid sprays was conducted. The sprays were produced by impinging two liquid jets. The liquid was molten wax and the gas was nitrogen. The use of molten wax allowed for a quantitative measure of the resulting dropsize distribution. The

results of this study, indicate that a significant amount of droplet breakup will occur as a result of the action of the gas on the liquid droplets. Empirical correlations are presented in terms of parameters that were found to affect the mass median dropsize most significantly, the orifice diameter, the liquid injection velocity, and the maximum gas velocity. An empirical correlation for the normalized dropsize distribution is also presented. These correlations are in a form that may be incorporated readily into existing combustion model computer codes for the purpose of calculating rocket engine combustion performance. Author

N73-31249*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREE-STREAM TEMPERATURE, DENSITY, AND PRESSURE MEASUREMENTS IN AN EXPANSION TUBE FLOW
Kenneth V. Haggard Washington Oct. 1973 52 p refs
(NASA-TN-D-7273; L-8788) Avail: NTIS HC $3.50 CSCL 20D

An experimental study was conducted to determine test-flow conditions in the Langley pilot model expansion tube. Measurements of temperature, density, wall pressure, pitot pressure, and shock and interface velocities were compared with theoretical calculations based on various models of the flow cycle. The vibrational temperature and integrated density of the molecular oxygen component of the flow were measured by use of vacuum ultraviolet absorption techniques. These measurements indicate both the presence and possible degree of nonequilibrium in the flow. Data are compared with several simplified models of the flow cycle, and data trends are discussed. Author

N73-31250# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON KELVIN WAVES IN A SEMI-INFINITE ROTATING BASIN WITH STEP-CHANGE IN THE DEPTH
S. A. Gabov 1972 6 p ref Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat. i Mekhan. (Moscow), no. 3, 1973 p 121-127
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The possibility of the existence of undamped progressive waves of the Kelvin wave type in a rotating basin is discussed and example of their orgin is presented. Author

N73-31251# Lockheed Missiles and Space Co., Palo Alto, Calif.
MECHANISM OF VORTEX RING FORMATION
P. A. Petrov 1972 9 p refs Transl. into ENGLISH from Izd. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 2, 1973 p 19-26
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

It was proved, experimentally, that a vortex ring is produced by a deceleration of the central part of the stream and that the magnitude of the fluid mass participating in the formation of the ring can vary during its formation. The possibility of obtaining fluid vortex bunches in the form of spheres and spheroids was also established. Author

N73-31252*# Kentucky Univ., Lexington. Dept. of Mechanical Engineering.
VISCOUS HYDRODYNAMIC INSTABILITY THEORY OF THE PEAK AND MINIMUM POOL BOILING HEAT FLUXES
Vijay K. Dhir Nov. 1972 72 p refs
(Grant NGR-18-001-035)
(NASA-CR-134492; UKY-BU100) Avail: NTIS HC $5.75 CSCL 20D

Liquid viscosity was included in the Bellman-Pennington theory of the Taylor wave in a liquid vapor interface. Predictions of the most susceptible wavelength, and of the wave frequency, were made as a function of a liquid viscosity parameter and the Bond number. The stability of a gas jet in a viscous liquid was studied and the result is used to predict the peak heat flux on large horizontal heaters. Experimental measurements of the dominant Taylor wave and its growth rate were made during the film boiling of cyclohexanol on cylindrical heaters. The results bear out the predictions quite well. The thickness of the vapor blanket surrounding a cylindrical heater was measured and a correlation suggested. The effect of large fluxes of vapor volume on the dominant wavelength was also noted. Theoretical results of the peak heat flux are compared with the experimental data, and the effect of finite geometry of flat plate heaters on the peak heat flux is also discussed. Author

N73-31253*# Illinois Univ., Urbana. Mechanical Engineering Dept.
A STUDY OF THE LOCAL PRESSURE FIELD IN TURBULENT SHEAR FLOW AND ITS RELATION TO AERODYNAMIC NOISE GENERATION Status Report, 31 Jul. 1972 - 31 Jan. 1973
Barclay G. Jones and H. Peter Planchon, Jr. 31 Jan. 1973 35 p refs
(Grant NGR-14-005-149)
(NASA-CR-134493; SR-5) Avail: NTIS HC $3.75 CSCL 20D

Work during the period of this report has been in three areas: (1) pressure transducer error analysis, (2) fluctuating velocity and pressure measurements in the NASA Lewis 6-inch diameter quiet jet facility, and (3) measurement analysis. A theory was developed and experimentally verified to quantify the pressure transducer velocity interference error. The theory and supporting experimental evidence show that the errors are a function of the velocity field's turbulent structure. It is shown that near the mixing layer center the errors are negligible. Turbulent velocity and pressure measurements were made in the NASA Lewis quiet jet facility. Some preliminary results are included. Author

N73-31254# Technische Univ., Berlin (West Germany). Sonderforschungsbereich Magnetohydrodynamik.
FRICTIONLESS EQUILIBRIUM FLOW OF SINGLE PHASE - TWO PHASE MIXTURES WITH LOW VAPOR CONTENT IN CONVERGENT-DIVERGENT NOZZLES (ISENTROPIC EVAPORATION EXPANSION)
Herbert Staedtke Mar. 1973 69 p refs In GERMAN; ENGLISH summary
(SFB-MHD-5) Avail: NTIS HC $5.50

The isentropic flow of evaporating two-phase mixtures in convergent-divergent nozzles is investigated. It is shown that the frictionless equilibrium two-phase flow with homogeneous distribution of both phases throughout the entire flow channel can be treated as a single-phase gas flow. The quantitative deviation from single-phase gas flow arises only through the differences in the state equations for two-phase mixtures. The subsonic and supersonic character of the two-phase flow, the calculation of the critical state in the throat, and the course of the expansion process in convergent-divergent nozzles are examined more precisely. In addition, the possibility of shock waves in the nozzle flow resulting from increased nozzle exit pressure is considered. The numerical solution of the basic equations is accentuated. ESRO

N73-31255# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Freiburg (West Germany). Inst. fuer Angewandte Mathematik und Mechanik.
AN INTEGRAL METHOD FOR THE COMPUTATION OF LAMINAR AND TURBULENT INCOMPRESSIBLE BOUNDARY LAYERS OF FLOW AND TEMPERATURE Ph.D. Thesis - Karlsruhe Univ., West Ger.
Burkhard Schulz-Jander 1973 77 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-24) Avail: NTIS HC $6.00; DFVLR, Porz, West Ger. 20,40 DM

The method was developed on the basis of two integral relations each for the flow and the temperature fields. In the case of turbulent flow calculations, an integral of the heat exchange rate in the boundary layer was determined from available experimental results and an approximation formula for the integral is given. Sample calculations and comparison with other experimental data show that the method yields reliable results for flows with strong pressure and/or temperature gradients in the flow direction even when the effective number varies significantly within the boundary layer. The method requires little storage capacity and computing time. Author (ESRO)

N73-31256# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.
SECOND ORDER BOUNDARY LAYER THEORY FOR

STEADY, LAMINAR, COMPRESSIBLE FLOWS OVER CURVED SURFACES Ph.D. Thesis - Tech. Univ., Berlin [GRENZSCHICHTTHEORIE ZWEITER ORDNUNG FUER STATIONAERE, LAMINARE, KOMPRESSIBLE STROEMUNGEN AN GEKRUEMMTEN OBERFLAECHEN]

Roger Gundmann 12 Jan. 1973 81 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-31) Avail: NTIS HC $6.25; DFVLR, Porz, West Ger. 26,10 DM

To calculate stationary, laminar, compressible flow, and temperature boundary-layers on cambered, two-dimensional or rotational bodies, a system of equations was derived by the method of magnitude analysis. It corresponds to a second order boundary-layer theory and contains information about the pressure gradient normal to the surface. The equations are discretized in flow direction, and a finite difference scheme of higher order is applied to the remaining direction. Author (ESRO)

N73-31257# Siemens A.G., Munich (West Germany). Forschungslab.

MINIATURIZATION IN FLUIDICS

Adolf Rechten Bonn Bundesmin. Fuer Forsch. und Technol. Apr. 1973 81 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-73-06) Avail: NTIS HC $6.25; ZLDI, Munich 16,65 DM

The characteristics of miniaturized fluidic elements are reported. Miniaturized elements can be made by a galvanoplastic procedure. Switching properties of elements with 0.1 millimeter nozzle width correspond to those of larger elements, their switching times are 50 to 60 microseconds. The most frequently used switching elements are derived from one basic shape. Two specimens of miniaturized sensors, matching the fluidic elements, are described. It is shown that integration of miniaturized fluidic switching circuits is possible with the use of vortex transformers. Author (ESRO)

N73-31258# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.

NUMERICAL COMPUTATION OF ONE-DIMENSIONAL UNSTEADY FLOW IN CHANNELS

Maurizio Pandolfi Apr. 1973 22 p refs

(Publ-138) Avail: NTIS HC $3.25

A numerical technique used in gasdynamics is here applied to the solution of one-dimensional unsteady flows in channels using the shallow water theory. Its most important feature is the explicit treatment of imbedded bores generated in the flow by coalescence of characteristics. Four numerical examples are presented to show possible applications of the method.

Author (ESRO)

N73-31259# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

A STUDY OF THE LARGE-SCALE RAREFIED FLOW FIELD THAT CAN BE OBTAINED THROUGH MOLECULAR EFFUSION FROM A PERFORATED BOUNDARY

Tor Ytrehus Feb. 1973 110 p refs Sponsored in part by the Norweg. Council for Tech. and Sci. Res.

(VKI-TN-79) Avail: NTIS HC $7.50

The large scale rarefied flow developing downstream of a porous wall in the case of molecular effusion through wall orifices was investigated. The theoretical analysis was based upon a momentum method using the one-dimensional Boltzmann equation with a particular formulation for the distribution function. A simple analytical solution was obtained in the case of Maxwell molecules. This method, which is an extension of Mott-Smith, is applied to solid boundary. Downstream of the one-dimensional kinetic flow, a large scale, three-dimensional continuum flow is established. The upstream flow was found to be restricted to the subsonic regime only. Various flux measurements were made in the flow field and at the solid boundary. Agreement was found between the theory and experiments. ESRO

N73-31260# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.

TRANSONIC VISCOUS INTERACTIONS Final Report, 1 Sep. 1969 - 31 Mar. 1973

F. O. Smetana 31 Mar. 1973 7 p refs

(Grant DA-ARO(D)-31-124-70-G95; DA-ARO(D)-31-124-G1162)

(AD-763295; AROD-8130-2-E) Avail: NTIS CSCL 20/4

The problem to which work reported addressed itself is, briefly, how can one predict the aerodynamic characteristics of airfoils at transonic speeds simply while at the same time including the effects of fluid viscosity. Author (GRA)

N73-31261# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.

NUMERICAL COMPUTATIONS OF SUPERCAVITATING HYDROFOILS ON PARABOLIC SHAPE WITH WU AND WANG'S EXACT METHOD

Okitsugu Furuya Jan. 1973 85 p refs

(Contract N00014-67-A-0094-0021)

(AD-763465; E79A.15) Avail: NTIS CSCL 13/10

Wu and Wang in 1963 proposed a method to solve a system of nonlinear integral equations obtained to determine the supercavitating (s/c) flow past arbitrary hydrofoil shapes in which a functional iterative method was used. The application of the method is presently concerned with arbitrary-shaped s/c hydrofoils, especially with those having rounded leading edges, since there have been no such successful results up to date. The rounded nosed body in the present paper was a parabolic strut and the position of the upper cavity separation point and the body thickness were changed in several ways while the cavitation number was fixed to be zero throughout the investigation. (Modified author abstract) GRA

N73-31262# Minnesota Univ., Minneapolis. Heat Transfer Lab.

TURBULENT ANNULAR SWIRL FLOWS Final Report, 1968 - 1973

C. J. Scott Jul. 1973 84 p refs

(Contract DAHC04-67-C-0021)

(AD-763916; HTL-110) Avail: NTIS CSCL 20/4

The report presents a brief summary of the swirl research done at the University of Minnesota up to the present and retails the characteristics of a new apparatus under construction and evaluation since July, 1970. The purpose of this apparatus is to study turbulent transport properties in non-decaying, swirling, annular vortex flows. By generating fully-developed, axial and tangential velocity profiles, coupled with fully developed temperature profiles, using an adiabatic, rotating inner wall and a stationary constant-heat-flux, outer wall, experimental values of the eddy diffusivities for momentum and heat were obtained. These transport coefficients are found to be influenced differently by the swirl distribution. (Modified author abstract) GRA

N73-31263# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

DRAG REDUCTION BY POLYMER ADDITION

Marten T. Landahl 1972 62 p Presented at the 13th Intern. Congr. of Theoret. and Appl. Mech., Moscow, 1972 Prepared in cooperation with the Royal Inst. of Technol.

(Contract F44620-71-C-0007)

(AD-763824; AFOSR-73-1200TR) Avail: NTIS CSCL 20/4

Special attention is paid to the changes in turbulence structure brought about by polymer additives, and an effort is made to understand these in the light of recent advances in the study of shear flow turbulence in ordinary fluids. Also a simplified theoretical model of shear flow wall turbulence is presented, with the aid of which an exploratory study of the influence of some non-Newtonian fluid properties is carried out. A particularly intriguing feature is the remarkable effectiveness of extremely high-molecular-weight polymers by which only a few parts per million of weight of solvent are sufficient in some cases to lead to drag reductions of 50 per cent or more. (Modified author abstract) GRA

N73-31264# Aeronautical Research Associates of Princeton, Inc., N.J.

LINEARIZED INTEGRAL THEORY OF THREE-DIMENSIONAL UNSTEADY COMPRESSIBLE FLOW IN A SHEAR LAYER BOUNDED BY AN OSCILLATING WALL

John E. Yates Jun. 1973 63 p refs

(Contract F44620-71-C-0132; AF Proj. 9782)

(AD-763807; ARAP-198; AFOSR-73-1124TR) Avail: NTIS

CSCL 20/4

A linearized integral theory is developed for calculating the pressure on a perturbed wall in three-dimensional unsteady supersonic flow in the presence of a shear layer. An explicit formula for the wall pressure is given for an array of panels undergoing simple harmonic motion. Asymptotic and numerical results are presented for the kernel of the wall pressure. The integral theory reduces the exact linearized inviscid theory in the limit of zero shear layer thickness. For a finite layer, there are three integral thickness parameters that contain the total effect of the shear layer. A critical Mach number is calculated (about 1.7) below which there is upstream influence and the kernel is attenuated by the shear layer. For supercritical Mach numbers, there is no upstream influence and the kernel has a pure oscillatory component. The amplitude is first order in the boundary layer thickness. (Modified author abstract) GRA

N73-31265# Naval Postgraduate School, Monterey, Calif.
ELECTRIC DISCHARGE STABILIZATION BY A HIGHLY TURBULENT FLOW M.S. Thesis
Robert Edward Nelson Jun. 1973 56 p refs
(AD-764468) Avail: NTIS CSCL 20/4

The work investigates an electric discharge operating in a turbulent flowing gas. Electric-discharge convection lasers are driven by such a discharge and any limit on discharge power will be a limit on the laser output. It has been observed that turbulence tends to allow more power to be applied but the exact mechanisms involved are not fully understood. To examine this phenomenon an air flow apparatus was fabricated that allowed control of flow rate, turbulence level, and discharge power. Turbulence data were taken with a hot-wire connected to a spectral analyzer. Discharge power consumption and breakdown voltage were recorded as a function of flow rate and turbulence spectrum. Results showed that with even a small flow rate discharge, current was raised by about a factor of two, with turbulence by about a factor of four; and with a large flow rate (100 m/sec) and strong turbulence, by about a factor of 100. Power at this last condition was raised by a factor of 200 over the no-flow case. Author (GRA)

N73-31266# Army Foreign Science and Technology Center, Charlottesville, Va.
APPROXIMATE CALCULATION OF HEAT AND MASS TRANSFER IN A TURBULENT BOUNDARY LAYER ON A SURFACE WITH ARBITRARY ROUGHNESS
I. K. Nikitin 24 Jul. 1973 8 p refs Transl. into ENGLISH from the book "Gidromekhanika" USSR, Naukova Dumka, 1971 p 68-73
(AD-764128; FSTC-HT-23-2287-72) Avail: NTIS CSCL 20/4

Heat and mass transfer in a turbulent boundary layer with arbitrary roughness is examined and approximate calculations are given. GRA

N73-31267# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF SECONDARY FLOW EFFECTS IN CURVED CHANNELS OF SQUARE CROSS SECTION M.S. Thesis
Paul Stephen Kenney Jun. 1973 66 p refs
(AD-764502) Avail: NTIS CSCL 20/4

In this study, turbulent flow in a curved channel of square cross section was investigated experimentally to determine secondary flow effects. Probe surveys were conducted to establish vortex and total pressure loss distribution in the exit plane of a 90 degree bend. Overall losses were determined by measuring the momentum of the flow with a force plate for different Reynolds numbers at turning angles of 0 degrees, 45 degrees, 90 degrees, and 135 degrees. Author (GRA)

N73-31268# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL STUDY OF TAYLOR-GOERTLER VORTICES IN A CURVED RECTANGULAR CHANNEL M.S. Thesis
Robert Joe McKee Jun. 1973 164 p refs
(AD-764503) Avail: NTIS CSCL 20/4

A rectangular cross section channel, with both a straight and a curved portion, was designed and built to create the laminar secondary Taylor-Goertler vortex flow. An aerosol was used to visualize these flow patterns, and photographs of the results are presented. A hot wire anemometer investigation of one location in the curved section was conducted to obtain the mean velocity profiles and turbulence levels. The pressure drop along both the straight and the curved sections was measured and compared. A constant temperature wall heater was also designed and installed in the straight section of the channel. Approximate values of the heating losses were obtained and the overall and local heat transfer coefficients were calculated for the straight portion of the channel. It was concluded that the vortices develop with both velocity increases and distance along the channel, and that the increase in pressure drop due to the vortices varied from near zero to approximately 20% with increasing Reynolds numbers. Author (GRA)

N73-31269# Naval Ordnance Lab., White Oak, Md.
HYPERSONIC, TURBULENT, COLD-WALL, SKIN-FRICTION AND HEAT-TRANSFER MEASUREMENTS ON AN AXISYMMETRIC SHARP CONE
Kuei-Yuan Chien 15 Jun. 1973 34 p refs
(AD-764059; NOLTR-73-108) Avail: NTIS CSCL 20/4

Turbulent skin-friction coefficients directly measured on an axisymmetric five-degree-half-angle sharp cone by two floating-element skin-friction balances at a free-stream Mach number of 7.9 are presented. Heat-transfer distributions are obtained simultaneously. These results yield directly the Reynolds analogy factor. Experimental data are used to evaluate four predictive methods. Except for the relatively low-Reynolds-number case, the directly measured sharp-cone Reynolds analogy factor is between 1.01 and 1.07, which is in good agreement with recent flat-plate measurements. Results indicate that the Stanton Number is essentially constant for one range and decreases by about 10 percent in another. (Modified author abstract) GRA

N73-31270# Naval Postgraduate School, Monterey, Calif.
THE COANDA EFFECT WITH JET DISPLACEMENT OVER PLANAR, CONCAVE, AND CONVEX WALLS M.S. Thesis
Leo James Michael Baird Dec. 1973 162 p refs
(AD-764506) Avail: NTIS CSCL 13/7

Bourque and Newman presented an extensive paper analyzing the separate effects of deflection angle and offset distance on the reattachment of flow issuing from a two-dimensional incompressible turbulent jet to an adjacent inclined flat plate. Levin and Manion combined the effects of offset distance and vertical wall incidence and derived a set of parametric equations to solve for the attachment distance at a given offset distance and deflection angle. Subsequently Perry extended the control volume model to account for inaccuracies in defining a base pressure. As part of a general investigation of the Coanda effect, the work of Levin and Manion has been expanded herein to encompass concave and convex surfaces of arbitrary planform. Two methods are outlined for determining the attachment distance for these additional planforms. (Modified author abstract) GRA

N73-31271# Army Foreign Science and Technology Center, Charlottesville, Va.
APPROXIMATE SOLUTION TO EQUATIONS OF DYNAMIC AND THERMAL BOUNDARY LAYERS FOR NON-NEWTONIAN FLUIDS WITH ARBITRARY PRESSURE AND SURFACE TEMPERATURE GRADIENTS
A. Sh. Dorfman 15 Mar. 1973 11 p refs Transl. into ENGLISH from Teplofiz. i Teplotekhn., Akad. Nauk Ukr. SSR, Inst. Tekhn. Teplofiz. (Kiev), no. 18, 1970 p 89-95
(AD-764170; FSTC-HT-23-1975-72) Avail: NTIS CSCL 20/4

The present study uses an approximate method of integrating boundary layer equations, with reference to Newtonian fluids, for integrating equations of motion and heat exchange of Newtonian fluids with exponential transport laws. GRA

N73-31272# Naval Ordnance Lab., White Oak, Md.
A FORWARD FACING STEP STUDY: THE STEP HEIGHT LESS THAN THE BOUNDARY-LAYER THICKNESS
Richard T. Driftmyer 11 May 1973 84 p refs
(AD-764512; NOLTR-73-98) Avail: NTIS CSCL 20/4

An experimental investigation involving a thick, adiabatic, naturally turbulent, two-dimensional boundary layer undergoing separation has been completed at the Naval Ordnance Laboratory (NOL). Forward facing steps (with attached end plates) were used to induce boundary-layer separation for the particular case

where the step heights, h, were less than the boundary-layer thickness, delta. The tests were conducted at a free-stream Mach number of 4.9 with a range of unit Reynolds numbers varying from 0.8 x 10 to the 6th power per foot to 4.0 x 10 to the 6th power per foot. The pressure distributions measured in the separated region ahead of the steps were found to be functions of both Re sub delta and h/delta for the turbulent boundary-layer separation case where h < delta.(Modified author abstract) GRA

N73-31273# Naval Postgraduate School, Monterey, Calif.
UNIDIRECTIONAL PERIODIC FLOW ABOUT CIRCULAR CYLINDERS M.S. Thesis
Richard Doyle Greenamyer Jun. 1973 62 p refs
(AD-764487) Avail: NTIS CSCL 20/4

The instantaneous force acting on a circular cylinder immersed in a unidirectional periodic flow characterized by U = V - (V sub A) sin 2 (PL) ft was investigated. The total force was divided into three components consisting of a steady-state drag; an oscillating drag which is a function of the frequency parameter lambda = fd/V ; and an inertial force which is also a function of the frequency parameter. The three resistance coefficients associated with the force components, (C sub D), (C sub D)(lambda), and (C sub M)(lambda) were calculated. It was found that the resistance coefficients are not materially affected by the free-stream oscillations whenever the frequency of the vortex shedding. However, when lambda- approaches the Strouhal frequency of vortex shedding, the inertia coefficient (C sub M) is significantly reduced, and likewise when lambda approaches the value of twice the Strouhal number, (C sub D)(lambda) is markedly reduced. In regions below this range, the inertial force becomes negligible. (Modified author abstract) GRA

N73-31274# Martin Marietta Corp., Baltimore, Md.
THREE DIMENSIONAL LAMINAR BOUNDARY LAYER OVER BODY OF REVOLUTION AT INCIDENCE. PART 6: GENERAL METHODS AND RESULTS OF THE CASE OF HIGH INCIDENCE
K. C. Wang May 1973 55 p refs Presented at the Div. of Fluid. Dyn. Meeting of the Am. Phys. Soc., Boulder, Colo., 20-22 Nov. 1972
(Contract F44620-70-C-0085; AF Proj. 9749)
(AD-763831; MML-TR-73-02C; AFOSR-73-1045TR) Avail: NTIS CSCL 20/4

The report presents general methods for calculating three-dimensional laminar boundary layers over inclined blunt bodies (not necessarily bodies of revolution). Complete incompressible results for a prolate spheroid at 30 degrees incidence are presented, and the computational procedures are described. The rule of the zone of dependence was observed. The results display for the first time the boundary layer structure over a non-spherical and non-conical blunt body in all details, and confirm the open-type of separation proposed earlier. Author (GRA)

N73-31275# Army Foreign Science and Technology Center, Charlottesville, Va.
CALCULATION OF THE HEAT EXCHANGE NEAR THE CRITICAL POINT OF A ROTATING BODY WHOSE SURFACE HAS VARIABLE TEMPERATURE
P. Bradeanu and E. Balogh 15 Mar. 1973 11 p refs Transl. into ENGLISH from Studia Univ. Babes-Bolyai, Ser. Math.-Mech (Cluj), no. 2, 1970 p 75-82
(AD-763941; FSTC-HT-23-2130-72) Avail: NTIS CSCL 20/4

The problem of calculating the heat exchange between a body and a moving fluid is of particular interest to practical applications of hydroaerodynamics. In order to solve this problem, various assumptions are made: there is a plane boundary layer; the surface temperature of the body is constant or variable; dissipation of the kinetic energy occurs through friction, etc. These physical assumptions simplify the mathematical methods of solving the problem, and permit self-modeled solutions. GRA

N73-31276# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BOUNDARY LAYER STUDIES ON A SPINNING CONE
Walter B. Sturek May 1973 47 p refs
(AD-762564; BRL-1649) Avail: NTIS CSCL 19/1

An experimental investigation of the effects of spin induced distortion of the boundary layer on a spinning 10 degree half angle cone at Mach 2, 3 and 4 is reported. The profile of the location of boundary layer transition has been determined completely about the surface of the cone model from spark shadowgraphs. These spark shadowgraphs were taken with the model mounted on an offset strut which was rolled incrementally in azimuth to reveal the entire surface of the model. The profile of the boundary layer thickness at the base of the cone has also been determined from the spark shadowgraphs. Strain gage balance measurements of Magnus and normal force were made for three significantly different boundary layer configurations and confirm the extreme sensitivity of Magnus to boundary layer configuration. Author (GRA)

N73-31277# Rochester Univ., N.Y. Dept. of Electrical Engineering.
CAVITATION DYNAMICS. 1: A MATHEMATICAL FORMULATION
Hugh G. Flynn 1 Aug. 1972 93 p refs
(Contract N00014-67-A-0398-0009; Nonr-668(18))
(AD-764075) Avail: NTIS CSCL 20/4

A set of equations was derived to describe the dynamical motions of small cavitation bubbles in liquids set into motion by an acoustic pressure field. The mathematical formulation takes into account heat conduction inside a bubble and in the surrounding liquid, and the viscosity, compressibility, and surface tension of the liquid. The effect of vapor pressure may be determined as a function of the interfacial temperature. The formulation consists of non-linear ordinary differential equations, integral equations and algebraic equations, and was programmed for solution on a digital computer. Author (GRA)

N73-31278# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
TIME EVOLUTION OF FINITE POWER DENSITY BLAST WAVES Interim Report
Romas Knystautas and John H. Lee Apr. 1973 37 p refs
(Grant AF-AFOSR-2387-72; AF Proj. 9711)
(AD-763834; MERL-73-3; AFOSR-73-1126TR) Avail: NTIS CSCL 20/4

In the report the experimental results of a detailed study of the time evolution of electrically generated finite power density cylindrical blast waves are presented. The detailed time history of the electrical energy release to the gas is obtained by simultaneous monitoring of the discharge voltage and the discharge current. The shock hydrodynamic flow structure is obtained via laser interferometry. (Modified author abstract) GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-31279 National Marine Fisheries Service, Washington, D.C.
EASTROPAC ATLAS. VOLUME 5: PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL DATA FROM PRINCIPAL PARTICIPATING SHIPS, SECOND SURVEY CRUISE, AUGUST - SEPTEMBER 1967
Cuthbert M. Love, ed. Sep. 1972 224 p
(NOAA-NMFS-Circ-330) Avail: SOD HC $4.75 per volume

An oceanographic survey of the resources in the eastern tropical Pacific Ocean was conducted. The physical oceanographic and meteorological data collected during a survey cruise period for August and September 1967 are presented. Charts are developed to show the following properties of the ocean: (1) oxygen saturation, (2) temperature distribution, (3) salinity, and (4) acceleration potential. P.N.F.

N73-31280 Michigan Univ., Ann Arbor.
MULTISPECTRAL REMOTE SENSING TECHNIQUES APPLIED TO SALINITY AND DRAINAGE PROBLEMS IN

THE COLUMBIA BASIN, WASHINGTON Ph.D. Thesis
Virginia Lee Prentice 1972 237 p
Avail: Univ. Microfilms Order No. 73-11232

Data collected and processed for a multispectral remote sensing program to investigate salinity and drainage problems in the irrigated area of the Columbia Basin were subjected to reexamination and indepth comparative analysis in light of the collected ground data and other available information pertaining to relevant facets of the physical environment. Analysis of scanner, thermal model, and field data indicated that original concepts were sound; soil moisture-temperature relationships can be predicted by modeling and are detectable by remote sensing techniques. Experimentation with the model by programming for transpiration and accounting for application of irrigation water should add to the utility of the model. Spectral signatures for several conditions of soil moisture and stages of vegetation stress were substantiated. Dissert. Abstr.

N73-31281 Denver Univ., Colo.
FORMULATION AND ANALYSIS OF A TILTED IMAGE DIPOLE MODEL OF THE MAGNETOSPHERE Ph.D. Thesis
Franklin D. Barish 1972 202 p
Avail: Univ. Microfilms Order No. 73-9234

A tilted image dipole model of the magnetosphere is constructed in which the earth's dipole is replaced by the full internal field expansion (GSFC 12/66). A choice of tail current sheet models is given including the Williams-Mead and Sauer representations. Allowance is made for the actual daily and seasonal changes in the orientation of the earth's dipole axis and neutral sheet with respect to solar magnetospheric xy plane. The tilted image dipole model for the magnetopause currents and Olson's spherical harmonic analysis derived through the self consistent field method of Mead and Beard are compared. An application of the model is given in diurnal and seasonal variations in conjugate point locations for high latitude stations.
Dissert. Abstr.

N73-31282 Boston Coll., Chestnut Hill, Mass.
THEORY OF MHD WEAKLY TURBULENT PLASMAS AND APPLICATIONS TO THE DIFFUSION OF PROTONS BY ALFVEN WAVES IN THE EARTH'S OUTER RADIATION BELTS Ph.D. Thesis
Orland Antonio DAmore 1972 273 p
Avail: Univ. Microfilms Order No. 73-11367

Magnetohydrodynamic plasma turbulence can be created in the equatorial region of the proton ring current by velocity space anisotropies in the particle distribution function; a review was made of the morphology of the magnetospheric domains that relate to this thesis. The resonant turbulence of MHD plasmons is studied assuming the plasma consists of a cold uniform background and a high energy tail, embedded in uniform magnetic field. The linear perturbation of the distribution is obtained by applying a single field input the linear gyroresonance propagator and the interaction operator for each mode to the non-perturbed equilibrium distribution. Also studied were particle diffusion in fluctuating plasma fields and mechanisms for the transport and acceleration of plasma sheet particles into the outer belts.
Dissert. Abstr.

N73-31283*# Nuclear Research Center, Athens (Greece).
LAND USE, FOREST DENSITY, SOIL MAPPING, EROSION, DRAINAGE, SALINITY LIMITATIONS Bimonthly Progress Report, 1 Dec. 1972 - 31 Jan. 1973
N. J. Yassoglou, Principal Investigator 31 Jan. 1973 10 p
Sponsored by NASA ERTS
(E73-10969; NASA-CR-133748) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. The results of analyses show that it is possible to obtain information of practical significance as follows: (1) A quick and accurate estimate of the proper use of the valuable land can be made on the basis of temporal and spectral characteristics of the land features. (2) A rather accurate delineation of the major forest formations in the test areas was achieved on the basis of spatial and spectral characteristics of the studied areas. The forest stands were separated into two density classes; dense forest, and broken forest. On the basis of ERTS-1 data and the existing ground truth information a rather accurate mapping of the major vegetational forms of the mountain ranges can be made. (3) Major soil formations are mapable from ERTS-1 data: recent alluvial soils; soil on quarternary deposits; severely eroded soil and lithosol; and wet soils. (4) An estimation of cost benefits cannot be made accurately at this stage of the investigation. However, a rough estimate of the ratio of the cost for obtaining the same amount information from ERTS-1 data and from conventional operations would be approximately 1:6 to 1:10, in favor of the ERTS-1.

N73-31284*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, period ending Aug. 1973
Harvey K. Nelson, Principal Investigator 1 Sep. 1973 3 p EREP
(NASA Order T-4114-B)
(E73-10972; NASA-CR-133751) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-31285*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Report, 1-31 Aug. 1973
I. J. Sattinger, Principal Investigator 12 Sep. 1973 1 p EREP
(Contract NAS9-13283)
(E73-10973; NASA-CR-133752; MR-4) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-31286*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Progress Report, 1-31 Aug. 1973
Charles E. Poulton, Principal Investigator 10 Sep. 1973 8 p EREP
(Contract NAS9-13286)
(E73-10979; NASA-CR-133758; MPR-7) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-31287*# National Marine Fisheries Service, Bay Saint Louis, Miss. Fisheries Engineering Lab.
INVESTIGATION USING DATA FROM ERTS TO DEVELOP AND IMPLEMENT UTILIZATION OF LIVING MARINE RESOURCES Progress Report, 20 Jul. - 10 Sep. 1973
William H. Stevenson, Principal Investigator and Edward J. Pastula, Jr. Sep. 1973 4 p ref ERTS
(NASA Order S-70246-AG)
(E73-10980; NASA-CR-133759; PR-6) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-31288*# Purdue Research Foundation, Lafayette, Ind. 02c
EVALUATION AND COMPARISON OF ERTS MEASUREMENTS OF MAJOR CROPS AND SOIL ASSOCIATIONS FOR SELECTED SITES IN THE CENTRAL UNITED STATES Bimonthly Progress Report, 1 Jul. - 31 Aug. 1973
Marion F. Baumgardner, Principal Investigator 31 Aug. 1973 6 p ERTS
(Contract NAS5-21785)
(E73-10981; NASA-CR-133760) Avail: NTIS HC $3.00

The author has identified the following significant results. An unsupervised classification was run for an area around Tahoka Lake, Texas. Classes from the unsupervised were correlated with the available ground observations. Unsupervised classes which corresponded to major rangeland composition groups were used as a basis for a classification of most of Lynn County. Three classes of pasture were identified: (1) clear pasture, mostly

grasses; (2) mixture of grasses and mesquite; and (3) areas of thick mesquite. In addition, one class called other included lakes and agricultural areas. It was found that differences in rangeland composition could be mapped from spectral data using computer-aided processing techniques. The T Bar Ranch, which surrounds the Double Lakes west of Tahoka, Texas, was chosen as a test area for the classification of rangeland. It was found that the classification was reasonably consistant with the low altitude oblique air photos.

N73-31289*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Jun. - 19 Aug. 1973
Donald H. VonSteen, Principal Investigator 19 Aug. 1973 16 p ref ERTS
(NASA Order S-70251-AG-3)
(E73-10982; NASA-CR-133761) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-31290*# Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Science.
PHOTOINTERPRETATION OF SKYLAB 2 MULTISPECTRAL CAMERA (S-190A) DATA: ADVANCE REPORT OF SIGNIFICANT RESULTS
Mead L. Jensen, Principal Investigator Sep. 1973 2 p EREP
(Contract NAS9-13322)
(E73-10983; NASA-CR-133762) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. A significant and possible major economic example of the practical value of Skylab photographs was provided by locating on Skylab Camera Station Number 4, frame 010, SL-2, an area of exposures of limestone rocks which were thought to be completely covered by volcanic rocks based upon prior mapping. The area is located less than 12 miles north of the Ruth porphyry copper deposit, White Pine County, Nevada. This is a major copper producing open pit mine owned by Kennecott Copper Corporation. Geophysical maps consisting of gravity and aeromagnetic studies have been published indicating three large positive magnetic anomalies located at the Ruth ore deposits, the Ward Mountain, not a mineralized area, and in the area previously thought to be completely covered by post-ore volcanics. Skylab photos indicate, however, that erosion has removed volcanic cover in specific sites sufficient to expose the underlying older rocks suggesting, therefore, that the volcanic rocks may not be the cause of the aeromagnetic anomaly. Field studies have verified the initial interpretations made from the Skylab photos. The potential significance of this study is that the large positive aeromagnetic anomaly suggests the presence of cooled and solidified magma below the anomalies, in which ore-bearing solutions may have been derived forming possible large ore deposits.

N73-31291*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SEDIMENT PATTERN CORRELATION WITH INFLOW AND TIDAL ACTION Progress Report, 1 Jul. - 31 Aug. 1973
Warren E. Grabau, Principal Investigator 13 Sep. 1973 3 p ERTS
(NASA Order S-70259-AG)
(E73-10984; NASA-CR-133763) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-31292*# Argus Exploration Co., Los Angeles, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Progress Report, 1 Jul. - 31 Aug. 1973
Mark A. Liggett, Principal Investigator 10 Sep. 1973 8 p ERTS
(Contract NAS5-21809)
(E73-10985; NASA-CR-133764) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-31293*# TRI-State Regional Planning Commission, New York.
INVESTIGATION OF SATELLITE IMAGERY FOR REGIONAL PLANNING: VISUAL INTERPRETATION OF BLACK/WHITE IMAGES AT 1:1000000 Progress Report
William Harting, Principal Investigator 7 Sep. 1973 13 p ERTS
(Contract NAS5-21738)
(E73-10986; NASA-CR-133765; PR-2) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-31294*# State of Ohio Dept. of Development, Columbus.
RELEVANCE OF ERTS TO THE STATE OF OHIO Progress Report, Jul. - Aug. 1973
David C. Sweet, Principal Investigator Aug. 1973 33 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21782)
(E73-10987; NASA-CR-133766) Avail: NTIS HC $3.75 CSCL 08F

The author has identified the following significant results. A significant result was the fabrication of an image transfer and comparison device. To avoid problems and high costs encountered in manual drafting methods, Battelle staff members have fabricated an inexpensive, yet effective, technique for transferring ERTS-1 analysis displays from the Spatial Data 32-Color Viewer to maps and/or aircraft imagery. In brief, the image transfer-comparison device consists of a 2-way mirror which functions similar to a zoom transfer scope. However, the device permits multiuser viewing and real time photographic recording (35-mm and Polaroid) of enhanced ERTS-1 imagery superimposed over maps and aircraft photography. Thirty-five mm, 70 mm, and 4 in. x 5 in. photographs are taken of 80% of the TV screen of the Spatial Data Density Slicing Viewer. The resulting black and white and color imagery is then used in transparent overlays, viewgraphs, 35-mm and 70-mm transparencies, and paper prints for reports and publications. Annotations can be added on the TV screen or on the finished product.

N73-31295*# General Electric Co., Philadelphia, Pa. Space Div.
ANALYSES AND APPLICATIONS OF MULTIPLE CYCLES OF ERTS-1 IMAGERY OVER COUNTY OF LOS ANGELES: ASSESSMENT OF DATA UTILITY FOR URBAN DEVELOPMENT AND REGIONAL PLANNING
Surendra Anant Raje, Principal Investigator, Richard Economy, Jene McKnight (Los Angeles County Reg. Planning Comm., Calif), Darryl Goehring (Los Angeles County Reg. Planning Comm., Calif.), and Gerald Willoughby (OVAACB Intern., Inc.) [1973] 16 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21797)
(E73-10989; NASA-CR-133768) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-31296*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDIES OF IMAGES OF SHORT-LIVED EVENTS USING ERTS DATA Progress Report, 1 May - 30 Jun. 1973
William A. Deutschman, Principal Investigator 30 Jun. 1973 1 p ERTS
(Contract NAS5-21858)
(E73-10990; NASA-CR-133769) Avail: NTIS HC $3.00 CSCL 14E

The author has identified the following significant results. Significant results are the continued detection of short-lived events. The following have been detected and analyzed: forest fires, oil spills, vegetation damage, volcanoes, storm ridges, and earthquakes. It is hoped that the Mississippi River flood scenes will

arrive shortly and then floods be added to the list of identified short-lived events.

N73-31297*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
LAND USE IN NORTHERN MEGALOPOLIS Progress Report
Robert B. Simpson, Principal Investigator 10 Sep. 1973 2 p ERTS
(Contract NAS5-21749)
(E73-10991; NASA-CR-133770; PR-8) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-31298*# Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Sciences.
GEOLOGICAL AND GEOCHEMICAL STUDIES IN THE ROBINSON MINING DISTRICT, WHITE PINE COUNTY, NEVADA, USING SKYLAB S190A IMAGERY Quarterly Report, period ending 20 Jul. 1973
M. L. Jensen, Principal Investigator, R. J. Rogers, and M. P. Erickson 1 Aug. 1973 5 p EREP
(Contract NAS9-13322)
(E73-10992; NASA-CR-133771) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. In the Robinson mining district which included the Ruth porphyry copper mines, three large positive aeromagnetic anomalies exist over a Tertiary volcanic area north west of Ruth. Prior studies of this area have suggested that the volcanics may or may not be the cause of the anomalies. Skylab SI90A imgagery, however, indicates possible outcrops in the volcanic area of the Paleozoic sediments. Field studies or ground truth verify the existence of these inliers suggesting that the magnetic anomaly may be the result of a buried intrusive body for which potential mineralization has been covered by the post-ore blanket of volcanics. The area is being mapped in more detail and samples of mercury-bearing soil-gas area being collected within and outside the area.

N73-31299*# Corps of Engineers, Waltham, Mass.
NEW ENGLAND RESERVOIR MANAGEMENT Progress Report
Saul Cooper and Duwayne Anderson, Principal Investigators (CRREL) 1 Sep. 1973 4 p EREP
(NASA Order T-4646-B)
(E73-10993; NASA-CR-133772) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-31300*# National Ocean Survey, Rockville, Md.
SKYLAB A PROPOSAL AEROTRIANGULATION WITH VERY SMALL SCALE PHOTOGRAPHY Quarterly Report, 15 Apr. - 15 Jul. 1973
Morton Keller, Principal Investigator 15 Jul. 1973 1 p EREP
(NASA Order T-4110-B)
(E73-10994; NASA-CR-133775) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N73-31301*# National Ocean Survey, Rockville, Md.
SKYLAB A PROPOSAL AEROTRIANGULATION WITH VERY SMALL SCALE PHOTOGRAPHY Quarterly Report, 15 Jan. - 15 Apr. 1973
Morton Keller, Principal Investigator 15 Apr. 1973 1 p EREP
(NASA Order T-4110-B)
(E73-10995; NASA-CR-133776) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N73-31302*# National Research Council, Bangkok (Thailand).
THAILAND NATIONAL PROGRAMME OF THE EARTH RESOURCES TECHNOLOGY SATELLITE Progress Report, May - Jul. 1973
Pradisth Cheosakul, Principal Investigator Aug. 1973 25 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E73-10996; NASA-CR-133777) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report.

N73-31303*# National Marine Fisheries Service, Bay Saint Louis, Miss.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 10 Aug. - 10 Sep. 1973
William H. Stevenson, Principal Investigator 12 Sep. 1973 3 p EREP
(NASA Order T-8217-B)
(E73-10997; NASA-CR-133778; MPR-4) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-31304*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Aug. 1973
Paul M. Merifield, Principal Investigator 5 Sep. 1973 3 p EREP
(Contract NAS2-7698)
(E73-10999; NASA-CR-133780; MPR-3) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-31305*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF SKYLAB MULTISPECTRAL PHOTOGRAPHY AND SCANNER IMAGES TO GEOLOGICAL INVESTIGATION OF THE BASIN-AND-RANGE-COLORADO PLATEAU BOUNDARY IN NORTH CENTRAL AND CENTRAL ARIZONA Progress Report, 1 Jun. - 30 Jul. 1973
Alexander F. H. Goetz, Principal Investigator 31 Aug. 1973 1 p EREP
(Contract NAS9-13394)
(E73-11000; NASA-CR-133781) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-31306*# Houston Univ., Tex. Wave Propagation Labs.
[SKYLAB OVERPASS AND VERIFICATION OF LOCAL ENVIRONMENTAL AND SPATIAL FEATURES] Quarterly Report, May - Aug. 1973
H. S. Hayre, Principal Investigator 11 Sep. 1973 1 p EREP
(Contract NAS9-13462)
(E73-11001; NASA-CR-133782) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-31307*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Aug. 1973
Ronger M. Hoffer, Principal Investigator 18 Sep. 1973 9 p EREP
(Contract NAS9-13380)
(E73-11002; NASA-CR-133785) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-31308*# Stanford Univ., Calif. School of Earth Sciences.
FEASIBILITY OF USING S-191 INFRARED SPECTRA FOR GEOLOGICAL STUDIES FROM SPACE Monthly Report

2 Aug. - 1 Sep. 1973
R. J. P. Lyon and A. A. Green, Principal Investigators 1 Sep. 1973 3 p EREP
(Contract NAS9-13357)
(E73-11003; NASA-CR-133786) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-31309*# Nevada Univ., Reno. Mackay School of Mines.
THE GREAT BASIN INVESTIGATION Monthly Progress Report, Aug. 1973
Jack G. Quade, Principal Investigator 10 Sep. 1973 2 p EREP
(Contract NAS9-13274)
(E73-11004; NASA-CR-133787) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-31310*# Kansas Univ. Center for Research, Inc., Lawrence.
INTERPRETATION OF LAND USE AND STREAM ORDER, PAWNEE RIVER BASIN, KANSAS
S. A. Morain, Principal Investigator and Donald L. Williams 14 Sep. 1973 6 p ref ERTS
(Contract NAS5-21822)
(E73-11005; NASA-CR-133798) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Land use and stream orders were mapped from ERTS-1 imagery covering the Pawnee River Basin. Total area of the basin, irrigated dry land crop area, and rangeland area were determined. The stream order of the basin was calculated by the Strahler method and provided more detail than is available on the comparable 1:250,000 sheets. This study has demonstrated the feasibility of using ERTS-1 imagery to map stream networks in greater detail than is required for 1:250,000 scale. The utility of ERTS-1 has also been demonstrated for mapping and mensuration of data relating to performance of ground cover types and the extent of irrigation.

N73-31311*# International Imaging Systems, Mountain View, Calif.
OCEAN WATER COLOR ASSESSMENT FROM ERTS-1 RBV AND MSS IMAGERY Progress Report, 8 Jul. - 7 Sep. 1973
D. S. Ross, Principal Investigator 7 Sep. 1973 13 p ERTS
(Contract NAS5-21862)
(E73-11006; NASA-CR-133799; C200-3) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified results in this report.

N73-31312*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
A TECHNIQUE FOR INTERPRETATION OF MULTISPECTRAL REMOTE SENSOR DATA
A. N. Williamson 19 Sep. 1973 15 p Presented at the Am. Soc. of Photogrammetry Symp. on Remote Sensing in Oceanography, Orlando, Fla., 2-5 Oct. 1973 Sponsored by NASA ERTS
(E73-11007; NASA-CR-133800) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. The U.S. Army Engineer Waterways Experiment Station is engaged in a study to detect from ERTS-1 satellite data alterations to the absorption and scattering properties caused by movement of suspended particles and solutes in selected areas of the Chesapeake Bay and to correlate the data to determine the feasibility of delineating flow patterns, flushing action of the estuary, and sediment and pollutant dispersion. As a part of this study, ADP techniques have been developed that permit automatic interpretation of data from any multispectral remote sensor with computer systems which have limited memory capacity and computing speed. The multispectral remote sensor is considered as a reflectance spectrophotometer. The data which define the spectral reflectance characteristics of a scene are scanned pixel by pixel. Each pixel whose spectral reflectance matches a reference spectrum is identified, and the results are shown in a map that identifies the locations where spectrum matches were detected and spectrum that was matched. The interpretation technique is described and an example of interpreted data from ERTS-1 is presented.

N73-31313*# General Electric Co., Beltsville, Md.
DATA COLLECTION PLATFORM/FIELD TEST SET PROGRAM Final Report, Jul. 1971 - Oct. 1972
G. C. VanNostrand, Principal Investigator and G. Meyerson 23 Apr. 1973 42 p refs ERTS
(Contract NAS5-21697)
(E73-11008; NASA-CR-133801; Doc-73SD4233) Avail: NTIS HC $4.25 CSCL 14B

There are no author-identified significant results in this report.

N73-31314*# Boeing Co., Seattle, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Aug. 1973
David L. Tingey, Principal Investigator Aug. 1973 1 p EREP
(Contract NAS9-13303)
(E73-11009; NASA-CR-133802) Avail: NTIS HC $3.00 CSCL 04A

There are no author-identified significant results in this report.

N73-31315*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Aug. 1973
Keenan Lee, Principal Investigator 18 Sep. 1973 5 p EREP
(Contract NAS9-13394)
(E73-11010; NASA-CR-133803) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-31316*# Calspan Corp., Buffalo, N.Y.
S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES Quarterly Report, 1 Jun. - 31 Aug. 1973
Kenneth R. Piech, Principal Investigator 31 Aug. 1973 5 p refs EREP
(Contract NAS9-13336)
(E73-11011; NASA-CR-133804; OR-2) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-31317*# Michigan State Univ., East Lansing.
[GROUND TRUTH ACQUISITION] Progress Report, Aug. 1973
Lester V. Manderscheid, Principal Investigator 19 Sep. 1973 1 p EREP
(Contract NAS9-13332)
(E73-11012; NASA-CR-133805) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-31318*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-31 Aug. 1973
A. G. Mourad and D. M. Fubara, Principal Investigators 17 Sep. 1973 9 p refs EREP
(Contract NAS9-13276)
(E73-11013; NASA-CR-133806; PR-6) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-31319*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC CALIBRATION OF EREP IMAGERY AND OCEANOGRAPHY OF BLOCK ISLAND

SOUND Monthly Progress Report, Sep. 1973
Edward Yost, Principal Investigator 20 Sep. 1973 3 p EREP
(Contract NAS9-13308)
(E73-11015; NASA-CR-133811) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-31320*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
[OIL POLLUTION DETECTION AND MONITORING FROM SKYLAB EREP] Quarterly Progress Report, 1 Jun. - 31 Aug. 1973
Robert Horvath, Principal Investigator 19 Sep. 1973 2 p EREP
(Contract NAS9-13281)
(E73-11016; NASA-CR-133812; QPR-2) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-31321*# Minnesota Univ., St. Paul. Inst. of Agriculture Remote Sensing Lab.
ERTS-1 DATA APPLICATIONS TO MINNESOTA FOREST LAND USE CLASSIFICATION Annual Progress Report
Joseph E. Sizer, Principal Investigation (Minn. State Planning Agency), Ralph G. Eller, Merle P. Meyer, and Joseph J. Ulliman 1 Jul. 1973 35 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21801)
(E73-11017; NASA-CR-133813; IARSL-73-2) Avail: NTIS HC $3.75 CSCL 02F

The author has identified the following significant results. Color-combined ERTS-1 MSS spectral slices were analyzed to determine the maximum (repeatable) level of meaningful forest resource classification data visually attainable by skilled forest photointerpreters for the following purposes: (1) periodic updating of the Minnesota Land Management Information System (MLMIS) statewide computerized land use data bank, and (2) to provide first-stage forest resources survey data for large area forest land management planning. Controlled tests were made of two forest classification schemes by experienced professional foresters with special photointerpretation training and experience. The test results indicate it is possible to discriminate the MLMIS forest class from the MLMIS nonforest classes, but that it is not possible, under average circumstances, to further stratify the forest classification into species components with any degree of reliability with ERTS-1 imagery. An ongoing test of the resulting classification scheme involves the interpretation, and mapping, of the south half of Itasca County, Minnesota, with ERTS-1 imagery. This map is undergoing field checking by on the ground field cooperators, whose evaluation will be completed in the fall of 1973.

N73-31322*# Earth Satellite Corp., Washington, D.C.
SAMPLING STRATEGIES IN LAND USE MAPPING USING SKYLAB DATA Monthly Progress Report, Aug. 1973
David S. Simonett, Principal Investigator Aug. 1973 5 p EREP
(Contract NAS9-13314)
(E73-11018; NASA-CR-133814; MPR-3) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-31323*# TRW Systems Group, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION TECHNIQUES FOR ERTS IMAGES Semiannual Report, Mar. - Aug. 1973
Samuel S. Rifman, Principal Investigator Sep. 1973 13 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21814)
(E73-11019; NASA-CR-133816; TRW-20634-6002-RU-00) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N73-31324*# Geological Survey, Washington, D.C.
IRON-ABSORPTION BAND ANALYSIS FOR THE DISCRIMINATION OF IRON-RICH ZONES Progress Report, 1 Jan. - 30 Jun. 1973
Lawrence C. Rowan, Principal Investigator 10 Jul. 1973 26 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG-4)
(E73-11020; NASA-CR-133817) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. Study has concentrated on the two primary aspects of the project, structural analysis through evaluation of lineaments and circular features and spectral analyses through digital computer-processing techniques. Several previously unrecognized lineaments are mapped which may be the surface manifestations of major fault or fracture zones. Two of these, the Walker Lane and the Midas Trench lineament system, transect the predominantly NNE-NNW-trending moutain ranges for more than 500 km. Correlation of major lineaments with productive mining districts implies a genetic relationship, the 50 circular or elliptical features delineated suggest a related role for Tertiary volcanism. Color-ratio composites have been used to identify limonitic zones and to discriminate mafic and felsic rock by combing diazo color transparencies of three different ratios. EROS Data Center scene identification number for color composite in this report is ER 1 CC 500. Refinement of enhancement procedures for the ratio images is progressing. Fieldwork in coordination with both spectral and structural analyses is underway.

N73-31325*# Oregon State Univ., Corvallis. Rangeland Resources Program.
INVENTORY AND MONITORING OF NATURAL VEGETATION AND RELATED RESOURCES IN AN ARID ENVIRONMENT: A COMPARATIVE EVALUATION OF ERTS-1 IMAGERY Progress Report, 1 Mar. - 31 Aug. 1973
Barry J. Schrumpf, Principal Investigator, James R. Johnson, David A. Mouat, and William T. Pyott 20 Sep. 1973 14 p refs ERTS
(Contract NAS5-21831)
(E73-11021; NASA-CR-133818) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. A comparative evaluation of an ERTS-1 MSS color reconstitution and an Apollo 6 and Gemini 4 color photograph for information content was conducted. A greater variety of image detail was indicated for the Apollo 6 imagery. A study of terrain feature variable-vegetation relationships has been concluded. However, there were no substantial differences among space photo types when macrorelief classes were interpreted. Vegetation distribution is influenced in varying degrees by characteristics of the terrain, some of which are quite apparent on ERTS-1 imagery and, therefore, provide the means for inferring possible vegetation types for a specified location. Spectral signatures have been determined for some natural vegetation systems from the ERTS-1 MSS data. Those signatures have been used to classify ERTS-1 data for a portion of the study area. Work continues on multistage sampling for natural vegetation, terrain feature identification of ERTS-1 photographs, plant phenology, and spectral signature studies.

N73-31326*# Wyoming Univ., Laramie. Dept. of Geology.
ANALYSIS OF ERTS-1 IMAGERY AND ITS APPLICATION TO EVALUATION OF WYOMING'S NATURAL RESOURCES Progress Report, Jul.- Aug. 1973
Ronald W. Marrs 15 Sep. 1973 10 p ERTS
(Contract NAS5-21799)
(E73-11022; NASA-CR-133819; ERTS-1-1-73D) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. A summary of the significant results of the studies completed during the July-August, 1973 period includes: (1) ERTS-1 image brightness contrasts can be related to important contrasts in rangeland and forest vegetation communities of the Laramie Basin. (2) Stereoscopic viewing is essential for correct structural interpretation in outcrop patterns in some areas. (3) Complex fracture patterns which may have exerted a controlling influence

on intrusive activity in the Absaroka Mountains can be mapped from ERTS. (4) Volcanic lithologies of the Yellowstone region are often differentiated on the basis of their textures, and cannot be successfully mapped by photogeologic interpretation of ERTS-1 imagery. Ground spectral readings confirm a general lack of contrast between these lithologies in the four ERTS-1 MSS bands. (5) Major dune fields can be recognized and defined from ERTS-1 image interpretations and recognition of differences in stabilizing plant communities (some of which may be mappable from ERTS-1) yields information about migration history of the dune fields.

N73-31327*# Geological Survey, Menlo Park, Calif.
IDENTIFICATION OF GEOSTRUCTURES OF CONTINENTAL CRUST, PARTICULARLY AS THEY RELATE TO MINERAL-RESOURCE EVALUATION Progress Report, 1 Jul. - 31 Aug. 1973
George Gryc, Principal Investigator and Ernest H. Lathram 4 Sep. 1973 3 p ERTS
(NASA Order S-70243-AG-1)
(E73-11023; NASA-CR-133820) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-31328*# National Center for Earthquake Research, Menlo Park, Calif.
INVESTIGATION OF PROTOTYPE VOLCANO-SURVEILLANCE NETWORK Progress Report, 1 Jul. - 31 Aug. 1973
Jerry P. Eaton, Principal Investigator and Peter L. Ward 1 Sep. 1973 3 p ERTS
(NASA Order S-70243-AG-2)
(E73-11024; NASA-CR-133821) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-31329*# Geological Survey, Denver, Colo.
EVALUATION OF ERTS-1 IMAGERY FOR MAPPING QUATERNARY DEPOSITS AND LANDFORMS IN THE GREAT PLAINS AND MIDWEST Progress Report, 1 Jan. - 30 Jun. 1973
Roger B. Morrison, Principal Investigator and George R. Hallberg (Iowa Geol. Survey, Iowa City) 1 Jul. 1973 10 p ERTS
(NASA Order S-70243-AG-1)
(E73-11025; NASA-CR-133822) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Maps of 1:1 million scale exemplifying the first phase of investigation were prepared for ten study areas (mostly 1 deg x 2 deg in area): 2 in Kansas, 1 in Missouri-Kansas, 2 in Nebraska, 1 in South Dakota, 3 in Illinois, and 1 in Iowa-Illinois (a total of 13 such maps, covering about 97,000 sq. mi., since the start of the project). Collection of all pertinent published geologic-terrain data also has been completed for all the study areas for which these first-phase maps have been made. The ground truth data are being used in combination with additional interpretation of the repetitive ERTS-1 images of most of these study areas to prepare enhanced information maps at 1:500,000. For areas that have not been mapped at 1:500,000 or larger scales, the maps will provide the first moderately detailed information on landform features and surficial materials. Much of the information mapped is significant for exploration and development of ground water (and locally petroleum) and for applications in engineering and environmental geology, and land use patterns as indicated by tone and texture on the images. Numerous moraines have been identified; also, the trends of parts of ancient filled valleys have been identified. Valley alinement appears controlled by faults or other structural lineaments.

N73-31330*# Geological Survey, Washington, D.C.
THE UTILIZATION OF ERTS-1 GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Jul. - 31 Aug. 1973
Daniel B. Krinsley, Principal Investigator 31 Aug. 1973 2 p ERTS
(NASA Order S-70243-AG-3)
(E73-11026; NASA-CR-133823) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-31331*# Bureau of Reclamation, Denver, Colo.
APPLICATION OF REMOTE SENSING TO SELECTED BUREAU OF RECLAMATION PROJECTS Progress Report, 1 Jul. - 31 Aug. 1973
Larry D. Cast, Principal Investigator 1 Sep. 1973 2 p ERTS
(NASA Order S-70243-AG)
(E73-11027; NASA-CR-133824) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-31332*# Geological Survey, Miami, Fla.
MAPPING DYNAMIC HYDROLOGIC CONDITIONS OF SURFACE WATER CHANGES IN SOUTH FLORIDA USING REPETITIVE ERTS-1 DATA INTERFACED WITH DCP'S Progress Report, 1 Jun. - 31 Jul. 1973
Aaron L. Higer, Principal Investigator, A. E. Coker, E. H. Cordes, and E. T. Wimberly Jul. 1973 9 p ERTS
(NASA Order S-70243-AG-7)
(E73-11028; NASA-CR-133825) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-31333*# Aerospace Corp., Los Angeles, Calif.
STUDY TO DEMONSTRATE THE FEASIBILITY OF AND DETERMINE THE OPTIMUM METHOD OF REMOTE HAZE MONITORING BY SATELLITE Progress Report, 1 Jun. - 31 Jul. 1973
Ernest H. Rogers, Principal Investigator 31 Jul. 1973 2 p ERTS
(Contract NAS5-21719)
(E73-11029; NASA-CR-133861) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

N73-31334*# Bureau of Sport Fisheries and Wildlife, Washington, D.C.
AN EVALUATION OF SPACE ACQUIRED DATA AS A TOOL FOR MANAGEMENT OF WILDLIFE HABITAT IN THE STATE OF ALASKA Progress Report, 1 May - 31 Aug.1973
Billy J. VanTries, Principal Investigator 1 Sep. 1973 3 p ERTS
(NASA Order S-70243-AG-1)
(E73-11030; NASA-CR-133862) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-31335*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, period ending 31 Aug. 1973
Roland S. Yunghans, Edward B. Feinberg, Frank J. Wobber, Robert L. Mairs, Principal Investigators, Robert T. Macomber, and Dennis Stanczuk 12 Sep. 1973 12 p Prepared for N. J. Dept. of Environ. Protect. ERTS
(Contract NAS5-21765)
(E73-11031; NASA-CR-133864) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. Rates of erosion and accretion of the shoreline are being calculated for two test areas along the New Jersey coast. Measurements are made on aerial photographs taken over the last 20 years and processed by computer. The rates are presented in graphic form on an ERTS-1 base map at a scale of 1:125,000. These rates are being used to determine the effectiveness of various shore protection structures at preventing sand removal and encouraging sand accumulation. Information on maintenance and construction expenditures is being used to obtain a

cost effectiveness ratio for various shore protection devices. The relationship of erosion rates, property value, and project cost are all criteria for selection of site type and extent of a shore protection structure. Compilation and evaluation of historical data will identify past decision making patterns. The effectiveness of these decisions with respect to erosion rates, property value, and project cost, can be usdd as an added criteria for future allocation of money and the selection of site and type of structure to be built.

N73-31336*# Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Sciences.
FRACTURE TRENDS IDENTIFIED BY ERTS-1 IMAGERY IN UTAH AND NEVADA
Mead L. Jensen, Principal Investigator, M. P. Erickson, and M. R. Smith 24 Aug. 1973 102 p ERTS
(Contract NAS5-21883)
(E73-11032; NASA-CR-133880) Avail: NTIS HC $7.25 CSCL 08E

The author has identified the following significant results. In the Utah-Nevada area, linear structural trends recorded on ERTS-1 imagery conform in part to previously recognized structures. In addition, the ERTS-1 imagery reveals cryptic structures not previously identified and not readily apparent in other imagery. These structures are illustrated by prominent east-west trending structures which appear to be concentrated in pre-volcanic rocks. This suggests that the structures are older than many of those with other trends which are equally prominent in volcanic and non-volcanic terrain. Since the older east-west structures may have controlled early Tertiary emplacement of magma or the ascent of mineralizing fluids, their recognition is important in minerial exploration. Soil-gas sampling and analysis for mercury content is being continued over structures, and projected trends of buried structures which appear, from studies of ERTS-1 imagery, to be favorable to mineralization. Comparison of ERTS-1 and Skylab imagery indicated that ERTS-1 imagery records more previously unrecognized linear structures than the Skylab imagery. In differentiating and identifying different rock types, the Skylab imagery appears to be more effective.

N73-31337*# Wolf Research and Development Corp., Pocomoke City, Md.
APPLICABILITY OF SATELLITE REMOTE SENSING FOR MONITORING SURFACE MINING ACTIVITIES Quarterly Progress Report, 8 Jun. - 8 Sep. 1973
R. L. Brooks, Principal Investigator and J. D. Pennewell 24 Sep. 1973 7 p EREP
(Contract NAS9-13310)
(E73-11033; NASA-CR-133865; QPR-2) Avail: NTIS HC $3.00 CSCL 08I

There are no author-identified significant results in this report.

N73-31338*# Indiana Geological Survey, Bloomington.
STUDY OF APPLICATION OF ERTS-A IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Significant Results Report
Charles Wier, Frank J. Wobber (Earth Satellite Corp., Washington, D. C.), Orville R. Russell, and Kenneth R. Martin, Principal Investigators 28 Sep. 1973 1 p ERTS
(Contract NAS5-21795)
(E73-11034; NASA-CR-133866) Avail: NTIS HC $3.00 CSCL 08I

The author has identified the following significant results. Mined land reclamation analysis procedures developed within the Indiana portion of the Illinois Coal Basin were independently tested in Ohio utilizing 1:80,000 scale enlargements of ERTS-1 image 1029-15361-7 (dated August 21, 1972). An area in Belmont County was selected for analysis due to the extensive surface mining and the different degrees of reclamation occurring in this area. Contour mining in this area provided the opportunity to extend techniques developed for analysis of relatively flat mining areas in Indiana to areas of roiling topography in Ohio. The analysts had no previous experience in the area. Field investigations largely confirmed office analysis results although in a few areas estimates of vegetation percentages were found to be too high. In one area this error approximated 25%. These results suggest that systematic ERTS-1 analysis in combination with selective field sampling can provide reliable vegetation percentage estimates in excess of 25% accuracy with minimum equipment investment and training. The utility of ERTS-1 for practical and reasonably reliable update of mined lands information for groups with budget limitations is suggested. Many states can benefit from low cost updates using ERTS-1 imagery from public sources.

N73-31339*# Geological Survey, Menlo Park, Calif.
IDENTIFICATION OF GEOSTRUCTURES OF CONTINENTAL CRUST, PARTICULARLY AS THEY RELATE TO MINERAL-RESOURCE EVALUATION Progress Report, 1 Jan. - 30 Jun. 1973
George Gryc, Principal Investigator and Ernest H. Lathram 30 Jun. 1973 10 p refs ERTS
(NASA Order S-70243-AG-1)
(E73-11035; NASA-CR-133881) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Analysis of lineated lakes in the Umiat, Alaska area and comparison with known geology, gravity, and magnetic data in the the area suggest concealed structures exist at depth, possibly at or near basement, which may represent targets for petroleum exploration. Compilation of reconnaissance geologic data on 1:250,000 scale enlargements of ERTS-1 images near Corwin reveal structural and stratigraphic anomalies that suggest the Cretaceous sequence is less thick than supposed and is repeated in a series of plates superimposed by flat thrust faults. The structural style differs from that in coeval strata to the north-east, across the northwest-trending linear zone separating differing tectonic styles in older strata noted earlier. The regional extension of a fault known locally in the McCarthy area has been recognized; this fault appears to form the boundary of a significant terrane of mid-Paleozoic metamorphic rocks. ERTS-1 images are being used operationally, at 1:1,000,000 scale in the compilation of regional geologic maps, and at 1:250,000 scale in field mapping in the Brooks Range, in the study of faults in seismically active southern Alaska, in field-checking interpretations previously made from ERTS-1 imagery, and orthophoto base maps for geologic maps.

N73-31340*# Environmental Research and Technology, Inc., Lexington, Mass.
STUDY TO DEVELOP IMPROVED SPACECRAFT SNOW SURVEY METHODS USING SKYLAB/EREP DATA Quarterly Progress Report, 14 Jun. - 15 Sep. 1973
James C. Barnes, Principal Investigator 15 Sep. 1973 5 p EREP
(Contract NAS9-13305)
(E73-11036; NASA-CR-133882; ERT-P-412-4-QPR-2) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. The initial analysis of EREP data from the SL-2 mission has been undertaken. Snow distributions are being mapped from the S190A photography for three mountain areas: the Sierra Nevadas; the Cascades near Washington-Oregon border; and the Wasatch Range in Utah. In the S192 screening film, a dramatic reversal in the reflectance of the snow in the Wasatch Range is observed between the visible and near IR channels. In channel 2 (0.46 - 0.51 microns) the snow has a high reflectance, whereas in channel 11 (1.55 - 1.75 microns) the snow appears almost black, having a much lower reflectance than the surrounding terrain. The sharp drop in reflectance in the near IR channel is believed to be due to the existence of melt water on the snow surface. Although investigators have reported this effect previously using ERTS-1 imagery, the S192 data provides the first opportunity to study quantitatively the snow reflectance in several visible and near IR channels. The results will have direct application for developing a technique to determine the condition of the snow surface (i.e., dry of melting), a significant parameter in snow hydrology.

N73-31341*# Environmental Research and Technology, Inc., Lexington, Mass.
EVALUATE THE APPLICATION OF ERTS-A DATA FOR DETECTING AND MAPPING SEA ICE Bimonthly Progress Report, 10 Jul. - 10 Sep. 1973
James C. Barnes, Principal Investigator 27 Sep. 1973 6 p ERTS

(Contract NAS5-21802)
(E73-11037; NASA-CR-133883; BMPR-5) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. The results of the analysis of data collected during the spring and summer demonstrate that ERTS-1 imagery has a high potential for monitoring arctic sea ice conditions during the time for maximum ice extent through ice-breakup season. In the eastern Beaufort Sea area, the combination of ERTS-1 orbital overlap and a high incidence of cloud-free conditions during the spring assures a high frequency of repetitive satellite coverage. In the mid-Beaufort Sea, numerous fractures and leads can be identified, even in the early spring data. Ice features that can be identified include: development of fractures leading to the formation of distinct ice floes; growth and deterioration of leads; evidence of shearing movements of ice masses; formation of new grey ice within leads; distinction between grey, grey-white, and older forms of ice; and the deterioration of the ice surface evidenced by the formation of puddles, thaw holes, and drainage patterns. Ice conditions in the Bering Sea near St. Lawrence Island reported by aircraft observers participating in the Bering Sea Expedition are in close agreement with the ice conditions mapped from the corresponding ERTS-1 imagery. Ice features identified were: boundaries between grey ice and first year ice, shear leads, and occurrence of open water.

N73-31342*# Army Coastal Engineering Research Center, Washington, D.C.
ESTUARY AND BARRIER ISLAND STUDY Progress Report, Jul. - Aug. 1973
Dennis W. Berg, Principal Investigator Aug. 1973 2 p ERTS (NASA Order S-70260-AG)
(E73-11041; NASA-CR-133922) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Scan line distortion is apparent in ERTS-1 imagery, imparting a serrated-edge appearance to shorelines. This feature however does not hinder observation and interpretation of broad features such as shoaling areas and sediment plumes. Shoaling in the backshore areas and inlets is easily discernible in spectral bands 4 and 5. Contrast between land and water is especially striking in spectral band 7, allowing easy identification of tidal flat areas.

N73-31343*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF SKYLAB MULTISPECTRAL PHOTOGRAPHY AND SCANNER IMAGES TO GEOLOGICAL INVESTIGATION OF THE BASIN-AND-RANGE-COLORADO PLATEAU BOUNDARY IN NORTH CENTRAL AND CENTRAL ARIZONA Progress Report, 1-31 Aug. 1973
Alexander F. H. Goetz, Principal Investigator 25 Sep. 1973 1 p Sponsored by NASA EREP
(E73-11042; NASA-CR-133923) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-31344*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF ATMOSPHERIC EFFECTS IN SKYLAB DATA Quarterly Report, 8 Mar. - 31 May 1973
Frederick J. Thomson, Principal Investigator 25 Jun. 1973 2 p EREP
(Contract NAS9-13272)
(E73-11043; NASA-CR-133928; QR-1) Avail: NTIS HC $3.00 CSCL 04A

There are no author-identified significant results in this report.

N73-31345# Royal Greenwich Observatory, Herstmonceux (England).
TIME AND LATITUDE SERVICE, JANUARY - MARCH 1973
Mar. 1973 19 p
Avail: NTIS HC $3.00

The results of Greenwich time and latitude service for the period from January to and including March 1973 are given in tabular form. E.H.W.

N73-31346# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
NEUTRAL LINE IN THE MAGNETOTAIL
Atsuhiro Nishida Jul. 1973 9 p refs
(ISAS-497-Vol-38-No-8) Avail: NTIS HC $3.00

A synoptic survey for the magnetotail neutral line and the associated plasma phenomena during substorms was studied to provide the observational basis for the nightside reconnection process. Observations made at different locations for different substorms were combined to detect the neutral line. Data from two satellites were used for each instance. The formation of the neutral line in the near-tail region due to the severe weakening or disruption of the cross-tail current flowing through the earthward end of the plasma sheet was shown. In the stage that immediately precedes the neutral-line formation, the nightside field lines are stretched to the tail-like configuration, and the cross-tail current is highly intensified in the region where it is soon to disappear. Suggestions of the nightside reconnection process that does not involve the neutral-line in the near-tail region are given. K.M.M.

N73-31347# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
NUMERICAL MODELING OF THE UPPER ATMOSPHERE
Takashi Tanaka and Kunio Hirao Jul. 1973 52 p refs
(ISAS-496-Vol-38-No-7) Avail: NTIS HC $4.75

Diurnal variations of the thermosphere and the ionosphere are calculated by solving simultaneous time-dependent continuity equations for: O(+), H(+), O2(+), and NO(+) ions; equations of motion for ions and neutrals; and the heat conduction equations for electrons, ions, and neutrals. It is shown that the calculated results for the structure of the ionosphere based on the two dimensional model show good agreements with observations. However, there seems to be some difficulties for the complete expression of the structure of the neutral atmosphere by the two dimensional model. Author

N73-31348*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
PHASE 1 OF THE EARTH RESOURCES DATA ANALYSIS PROGRAM Final Report, Jun. 1972 - May 1973
Jun. 1973 9 p
(Contract NAS9-12776)
(NASA-CR-133982) Avail: NTIS HC $3.00 CSCL 05B

Research completed in the Earth Resources Data Analysis Program is discussed along with recommendations for future study. Projects discussed include use of the Cholesky decomposition in feature selection and classification algorithms; optimal feature selection and extraction, probability density estimation and nonparametric classifiers; use of spatial information in classification; and model for crop row reflectance. The installation of LARSYS on the ICSA's IBM 370/155 is discussed, and a list of technical reports is included. K.M.M.

N73-31349# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
AEROSOL AND PRECIPITATION CHEMISTRY AT MAUNA LOA OBSERVATORY
H. J. Simpson Dec. 1972 62 p refs
(NOAA-TR-ERL-248-APCL-24) Avail: NTIS Avail: SOD HC $0.85 Domestic Postpaid or $0.60 GPO Bookstore

The contents of Fe, Mn, Zn, Cu, Ni, and Pb were measured in aerosols and precipitation. Descriptions are given of magnitude and location of possible sources of local contributions to samples collected at Mauna Loa, Hawaii. These are given to evaluate the use of heavy metal content of the atmosphere at Mauna Loa as a diagnostic method of aged aerosols present in clean tropospheric air and to provide indications of the amounts of urban produced aerosols mixed into the general hemispheric circulation. T.M.R.

N73-31350*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MOTION AND EARTH TIDES FROM BEACON EXPLORER C
David E. Kolenkiewicz, David E. Smith, and Peter J. Dunn (Wolf

Res. and Develop. Corp., Riverdale, Md.) May 1973 14 p refs Presented at the 1st Intern. Symp. on the Use of Artificial Satellites for Geodesy and Geodynamics, Athens, May 1973 Submitted for publication
(NASA-TM-X-70460; X-592-73-236) Avail: NTIS HC $3.00 CSCL 08E

Seventeen months of laser tracking of the Beacon Explorer C spacecraft by a Goddard Space Flight Center laser system were analyzed. The amplitude and phase of the solid-earth and ocean-tide perturbations of the orbit and the variation in latitude of the tracking station were determined. From an analysis of the orbital inclination obtained from 6 hour data spans the tidal perturbations of the orbit were found to have a magnitude equivalent to a second degree Love number, k sub 2, of 0.245 with a phase lag of about 3.2 degrees. These numbers are in complete agreement with values obtained previously from a much shorter data span, although k sub 2, is lower than the value derived from seismic data. This discrepancy is probably due to the influence of the oceans on the satellite result. After removing the tidal perturbations the residuals in inclination were of order 0.04 arcseconds. This implies that the variation in latitude of the station was being determined during the 17 months period with an rms deviation of about 1.4 meters with respect to the smoothed Bureau International de l'Heure values. Author

N73-31351*# Analytical Mechanics Associates, Inc., Seabrook, Md.
STATISTICAL PROCESSING OF PIONEER FRONT FILM DATA, PART 1 Final Report
Henry Wolf May 1973 8 p
(Contract NAS5-11978)
(NASA-CR-132797; AMA-73-24-Pt-1) Avail: NTIS HC $3.00 CSCL 03B

A program was constructed to read the data on impacts and positional information on Pioneer and to classify these events according to a number of different criteria. The program is flexible enough to permit the introduction of further criteria and additional classifications, should this appear desirable. Not all cards correspond to particle impacts on the Pioneer sensors, many are inserted only to supply Pioneer position information. Author

N73-31352*# Analytical Mechanics Associates, Inc., Seabrook, Md.
AN ESTIMATE OF PARTICLE FLUX FROM PIONEER 8 AND 9 PART 2 Final Report
Henry Wolf Feb. 1973 5 p ref
(Contract NAS5-11978)
(NASA-CR-132798; AMA-73-4-Pt-2) Avail: NTIS HC $3.00 CSCL 03B

Five years of particle impact data obtained from Pioneer 8 and 9 have established reliable frequency levels for the near ecliptic region covered. This analysis is concerned with obtaining a multiplier which permits an estimate of the particle flux through a 1-A.U. sphere centered at the sun. Author

N73-31353# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
RADAR MONITORING OF TURBULENCE AT THE TROPOPAUSE LEVEL
Hans Ottersten Jul. 1972 74 p refs
(NOAA-TR-ERL-243-WPL-21) Avail: SOD HC $0.95 Domestic Postpaid or $0.75 GPO Bookstore CSCL 04A

Turbulence due to vertical wind shear at the tropopause temperature inversion produces small-scale temperature irregularities which cause echoes on sensitive microwave radars and allow monitoring of the tropopause level and study of the progression of dynamic instability and turbulence generation in the clear atmosphere. For tropopause temperature below about minus 45 to minus 50 C, the structure constant C sub t squared a characteristic measure of temperature variability within the inertial subrange, may be determined from radar reflectivity with an error less than 3 db by neglecting water vapor contributions to refractive-index variability. If the mean vertical gradient of generalized potential temperature is known, a measure of the intensity of velocity perturbations in the inertial subrange may be evaluated directly from radar reflectivity. Two different radar techniques are currently used for monitoring of turbulent structures in the clear atmosphere. Author

N73-31354# New Hampshire Univ., Durham. Dept. of Physics.
MHD WAVE TRANSMISSION AND PRODUCTION NEAR THE MANGETOPAUSE
Allan Wolfe and Richard L. Kaufmann Jul. 1973 25 p refs
(Grant NSF GA-32501X)
Avail: NTIS HC $3.25 CSCL 04A

Explorer 12 magnetometer data was used to study MHD waves near the magnetopause. Waves, with periods from 30 sec. to 2 min. in satellite coordinates, are studied on 36 orbits. Some regions of the magnetopause appear to be stable, and here the magnetometer observations are consistent with calculations of wave transmission through a tangential discontinuity model of the magnetopause. Waves seen near other regions of the magnetopause are probably produced by the Kelvin-Helmholtz instability. The compressional wave power ratio (magnetosphere to magnetosheath) increases as the satellite crosses the magnetopause further away from the earth-sun line. It was concluded that three processes: fast wave transmission over greater angles of incidence, Kelvin-Helmholtz instability, and wave amplification can contribute to the observed compressional power ratio increase. Author

N73-31355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESEARCH NEEDS IN OCEAN COLOR DATA ANALYSIS
W. R. McCluney Sep. 1973 17 p refs .
(NASA-TM-X-70466; X-652-73-261) Avail: NTIS HC $3.00 CSCL 08J

The success of the effort to extract several subsurface oceanographic parameters from remotely sensed ocean color data will depend to a great extent upon the existence of adequate theoretical models relating the desired oceanographic parameters to the upwelling radiances to be observed. In order to guide the development of these models, and to check their accuracies, a considerable amount of experimental work must be performed. The theoretical and experimental work needed to develop techniques for the quantitative analysis of satellite ocean color data is described. Author

N73-31356*# Kanner (Leo) Associates, Redwood City, Calif.
A COMPARISON BETWEEN MEASURED TRANSMISSION AND EMISSION SPECTRA AND CALCULATED SPECTRA IN THE 9.6 MICRON REGION OF OZONE
D. Marzoch Washington NASA Sep. 1973 36 p refs Transl. into ENGLISH of "Ein Vergleich gemessener Transmissions- und Emisionsspektren mit berechneten Spektren in der 9.6 micron-Bande des Ozons", Lundwig-Maximilians-Univ., Munich, report MBFT-FBW-73-01, Jan. 1973 52 p
(Contract NASw-2481)
(NASA-TT-F-15110; MBFT-FBW-73-01) Avail: NTIS HC $4.00 CSCL 04A

Measurements of the atmospheric transmission and emission are compared with the calculated spectra obtained from Clugh and Kneizys' theoretical line parameters. The comparison shows that the use of these line data recently fitted to laboratory measurements of McCaa and Shaw by Rest leads to incorrect results. Spectra computed with the latest released theoretical line data compare well with transmission measurements made from the ground. However, there remains a noticeable discrepancy in comparison with IRIS-spectra obtained from the US satellite Nimbus 3. Author

N73-31357*# Minnesota Univ., St. Paul. Inst. of Agriculture Remote Sensing Lab.
REMOTE SENSING APPLICATIONS IN AGRICULTURE AND FORESTRY. APPLICATIONS OF AERIAL PHOTOGRAPHY AND ERTS DATA TO AGRICULTURAL, FOREST AND WATER RESOURCES MANAGEMENT Annual Progress Report
1 Jul. 1973 91 p refs
(Grant NGL-24-005-263)
(NASA-CR-135483; IARSL-73-1) Avail: NTIS HC $6.75 CSCL 14E

Remote sensing techniques are being used in Minnesota to

study: (1) forest disease detection and control; (2) water quality indicators; (3) forest vegetation classification and management; (4) detection of saline soils in the Red River Valley; (5) corn defoliation; and (6) alfalfa crop productivity. Results of progress, and plans for future work in these areas, are discussed. A.L.

N73-31358# Geological Survey, Laramie, Wyo.
GEOLOGY OF THE PROPOSED DEER CREEK RESERVOIR SITE CONVERSE COUNTY WYOMING
R. M. Breckenridge 1973 7 p refs
Avail: NTIS HC $3.00

The geology for the proposed Deer Creek Reservoir in Converse County, Wyoming is reported. The general geology of the region and the site is described along with an evaluation of the site relative to potential geologic problems. A schematic geologic cross section of the Deer Creek area and a generalized geologic map of the proposed reservoir site are included.
K.M.M.

N73-31359*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
ESTIMATING CROP ACREAGE FROM SPACE-SIMULATED MULTISPECTRAL SCANNER DATA
R. F. Nalepka and P. D. Hyde Aug. 1973 53 p refs
(Contract NAS9-9784)
(NASA-CR-134029; ERIM-31650-148-T) Avail: NTIS HC $4.75 CSCL 02C

The need for multispectral data processing methods to permit the estimation of proportions of objects and materials appearing within the instantaneous field of view of a scanning system is discussed. An algorithm developed for proportion estimation is described as well as other supporting processing techniques. Application of this algorithm to space-simulated multispectral scanner data is discussed and some results presented and compared. Results indicate that, for this data set, the true proportions of the various crops contained within this data set are with one exception more closely in agreement with the proportions determined by the proportion estimation algorithm than with the proportions determined by conventional classfication algorithm. Author

N73-31360*# Grumman Aerospace Corp., Bethpage, N.Y.
PHOTOMETRIC AND POLARIMETRIC MAPPING OF WATER TURBIDITY AND WATER DEPTH Final Report
John Halajian and Herbert Hallock Aug. 1973 148 p refs
(Contract NAS9-12963)
(NASA-CR-134030) Avail: NTIS HC $9.50 CSCL 08J

A Digital Photometric Mapper (DPM) was used in the Fall of 1971 in an airborne survey of New York and Boston area waters to acquire photometric, spectral and polarimetric data. The object of this study is to analyze these data with quantitative computer processing techniques to assess the potential of the DPM in the measurement and regional mapping of water turbidity and depth. These techniques have been developed and an operational potential has been demonstrated. More emphasis is placed at this time on the methodology of data acquisition, analysis and display than on the quantity of data. The results illustrate the type, quantity and format of information that could be generated operationally with the DPM-type sensor characterized by high photometric stability and fast, accurate digital output. The prototype, single-channel DPM is suggested as a unique research tool for a number of new applications. For the operational mapping of water turbidity and depth, the merits of a multichannel DPM coupled with a laser system are stressed. Author

N73-31361# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON MEANDERING OF EQUATORIAL FLOWS
A. S. Monin 1972 5 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 3, 1973 p 98-102
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

A study of Cromwell current flow is presented. The periods, wavelengths, and amplitudes of oscillations in equatorial flows and the particle trajectories within the flows are computed by using the inertial motion equations on the beta-plane and a sphere. The asymmetry of the Cromwell flow relative to the equator in the Pacific Ocean and its possible meandering is discussed. Extented layers with temperature inversions were detected at depths of 50 - 100m in the Cromwell current along the equator, which were produced by layer by layer meandering of the current. K.M.M.

N73-31362# National Oceanic and Atmospheric Administration, Rockville, Md. Center for Experiment Design and Data Analysis.
BOMEX PERIOD 3 UPPER OCEAN SOUNDINGS
Victor E. Delnore and John McHugh Jul. 1972 356 p refs
Avail: SOD HC $5.00

An atlas is presented which is designed to serve a threefold purpose: to present in graphical form a segment of the large volume of oceanographic data collected during the Barbados oceanographic and meteorological experiment (BOMEX); to inform potential users of the quality and character of these data, which are now available from the BOMEX temporary archive; and to provide a new partial description of an important part of the tropical ocean that lies at the confluence of waters from many sources. Observational procedures are described, the methods by which the data were reduced and edited are discussed, and comparisons are given between the data from the STD soundings and those obtained with hydrographic water sample bottles. Author

N73-31363*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
GENERATION AND PROPAGATION OF ELECTROMAGNETIC WAVES IN THE MAGNETOSPHERE Ph.D. Thesis
William W. L. Taylor May 1973 145 p refs
(Contract NAS1-81414; NAS5-11074; Grant NGL-16-001-002; NGL-16-001-043; NSF GA-31676)
(NASA-CR-133925; U-of-Iowa-73-16) Avail: NTIS HC $9.25 CSCL 04A

Characteristics of broadband ELF, VLF, and LF emissions in the magnetosphere were calculated assuming incoherent Cerenkov radiation from magnetospheric electrons with energies from 50 eV to 50 keV. Calculations were included to determine the ray paths of the emitted waves. A diffusive equilibrium model of the magnetosphere with an ionosphere, plasmapause, and a centered dipole magnetic field was used. Ray path calculations were done in three dimensions. Using simultaneous energetic electron and VLF data, comparisons were made between calculated and observed VLF hiss. Assuming a wave normal angle six degrees from the resonance cone angle, the calculated spectral densities are both two orders of magnitude below the observed spectral densities. It seems unlikely that VLF hiss is produced by incoherent Cerenkov radiation. The observed spectral shape of V-shaped VLF hiss is similar to that calculated from incoherent Cerenkov radiation. Author

N73-31364*# California Univ., Berkeley. Space Sciences Lab.
ELECTRICAL PROPERTIES OF DRY ROCKS Final Report
H. Morrison Jun. 1973 155 p refs
(Grant NGR-05-003-447)
(NASA-CR-133886; SSL-Ser-14-Issue-34) Avail: NTIS HC $9.75 CSCL 08G

The mechanism by which atmospheric moisture affects the conductivity and dielectric constant of rock specimens was studied in time and frequency domains. It is suggested that adsorbed water molecules alter the surface conductivity in a manner similar to that observed in semiconductors and insulators. Powdered basalts show a low-frequency dispersion produced by the atmospheric moisture remaining in the pore system of the sample in a high vacuum; this effect is attributed to isolated adsorption centers. Simulated lunar permafrost at 100 K and a vacuum of 10 to the -8th power torr together with data on lunar samples contaminated with atmospheric moisture and the dielectric properties of ice at various temperatures indicate that, if permafrost exists in the moon it should present a relaxation peak at approximately 300 Hz; for temperatures up to 263 K it may go up to 20 KHz. It is concluded that in order to have electrical steady state conditions in rock samples it is necessary to have volume charge accumulations at interfaces within the sample and at the electrode sample interface. A method for measuring heterogeneous dielectrics with non-negligible ohmic and dielectric conductivities is proposed and experimentally verified. Author

N73-31365*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE APPLICATION OF VLB INTERFEROMETRY TO EARTH MEASUREMENTS Final Report
Richard D. Michelini Apr. 1973 84 p refs
(Contract NSR-09-015-079)
(NASA-CR-135493) Avail: NTIS HC $6.25 CSCL 08E

Results of a four-phase development of capability in very long-baseline interferometry (VLBI) at the Smithsonian Astrophysical Observatory (SAO) are summarized. The objectives of the VLBI program at SAO are to: (1) develop the capability to collect, process, and analyze VLBI data; (2) determine experimentally the accuracy now attainable with VLBI and, within the constraints imposed by this accuracy, initiate a program of VLBI observations for geophysical applications; (3) identify all significant error sources and devise means for eliminating or correcting these errors; and (4) develop a long range plan for applying VLBI techniques to a program of earth physics measurements. Author

N73-31366*# California Univ., Santa Barbara.
[BIOGEOCHEMISTRY AND BIOGEOLOGY RESEARCH PROJECTS] Annual Progress Report, 1 Aug. 1972 - 31 Jul. 1973
Preston Cloud 31 Jul. 1973. 8 p refs
(Grant NGR-05-010-035)
(NASA-CR-135650) Avail: NTIS HC $3.00 CSCL 08G

Summaries of work initiated or completed during the year in the areas of biochemistry and biology are reported. Topics include: studying humic substances through geologic time; analyzing the benzene and hexane soluble portions of the benzene-methanol extracts from the same standard suite for hydrocarbons; finding a pyrolytic technique and applying it to single taxa of fossil microorganisms and individual microorganisms; and discovering to what extent humic substances become converted to kerogen and retained in sediments. A list of publications is included. K.M.M.

N73-31367*# Lockheed Aircraft Corp., Palo Alto, Calif. Research Lab.
ANALYSIS OF AURORAL PARTICLE FLUXES Final Report
C. R. Chappell 1 Aug. 1973 76 p refs
(Contract NASw-2212; Grant NGR-23-005-015; NSF GA-28690)
(NASA-CR-133889) Avail: NTIS HC $6.00 CSCL 04A

The study is reported of electron and proton precipitation in different auroral forms from data obtained by the TWINS 1 and 2. The measurement of the energy spectra and pitch angle distributions of auroral electrons is discussed along with the auroral electron code for predicting the scattering and energy loss of electrons covering the complete auroral energy spectrum. F.O.S.

N73-31368# Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. fuer Meteorologie.
REMOTE SOUNDING OF THE ATMOSPHERE BY OCCULTATION TECHNIQUE. PART 1: INSTRUMENT DEVELOPMENTS AND INFRARED-SPECTROSCOPIC INVESTIGATIONS [INDIREKTE SONDIERUNG DER ATMOSPHAERE MITTELS OKKULTATIONSTECHNIK. TEIL 1: INSTRUMENTELLE ENTWICKLUNGEN UND INFRAROTSPEKTROSKOPISCHE UNTERSUCHUNGEN]
Hans-Juergen Bolle, Martin Heidemann, Adalbert Leupolt, and Werner Voelker Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Apr. 1972 202 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-14-Pt-1) Avail: NTIS HC $12.25; ZLDI, Munich 61 DM

Experimental developments are reported for rocket sounding occultation measurements which have led to the construction of an interferometer for the near and intermediate infrared, and to the fabrication of a new kind of infrared interference filters. Laboratory measurements of the transmission spectra of atmospheric gases with high resolution (about 0.1/cm) by means of a vacuum grating spectrometer are described and compared with theoretical line by line computations from which improvements of the line parameters can be derived. For the processing of measured data, a computer program was developed which makes it possible to compute the signal changes for model atmospheres. Author (ESRO)

N73-31369# Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. fuer Meteorologie.
REMOTE SOUNDING OF THE ATMOSPHERE BY OCCULTATION TECHNIQUE. PART 2: EXPERIMENTAL AND THEORETICAL SPECTRA OF ATMOSPHERIC GASES IN THE INFRARED SPECTRAL REGION [INDIREKTE SONDIERUNG DER ATMOSPHAERE MITTELS OKKULTATIONSTECHNIK. TEIL 2: EXPERIMENTELLE UND THEORETISCHE SPEKTREN ATMOSPHAERISCHER GASE IM INFRAROTEN SPEKTRALBEREICH]
Adalbert Leupolt Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Apr. 1972 97 p In GERMAN Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-14-Pt-2) Avail: NTIS HC $7.00; ZLDI, Munich 61 DM

Experimental and theoretical infrared spectra of atmospheric hydrocarbon gases CO, CO2, and NH4 are presented. These spectra were obtained in connection with rocket sounding occultation measurements by means of a vacuum grating spectrometer. Theoretical line by line computations were carried out from which improvements of the line parameters were derived. Results of the computer processing of measured data, showing signal variations for model atmospheres, are given. ESRO

N73-31370# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Inst. fuer Geologie und Palaeontologie.
REMOTE SENSING AS APPLIED TO GEOLOGY. POSSIBILITIES AND PROBLEMS OF GEOLOGICAL REMOTE SENSING FROM AIRCRAFT AND SATELLITE [REMOTE SENSING IN DER GEOLOGIE. MOEGLICHKEITEN UND PROBLEME DER ERDERKUNDUNG MIT HILFE VON FLUGZEUGEN UND SATELLITEN]
Reinhard Guenther Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Sep. 1972 214 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-28) Avail: NTIS HC $12.75; ZLDI, Munich 44,55 DM

Parameters and application potential of remote sensing methods are presented, such as photography, infrared and multispectral scanning, TV imaging, side-looking radar, spectral photometry, and ultraviolet techniques. The kind and number of parameters affecting the signal were emphasized. The methods of data processing are outlined, including contrast enhancement and computer processing. Author (ESRO)

N73-31371# Bonn Univ. (West Germany). Inst. fuer Physik.
NEUTRAL PARTICLE DENSITIES AND TEMPERATURE MEASUREMENTS IN THE LOWER WINTER THERMOSPHERE AT POLAR LATITUDES [MESSUNGEN VON NEUTRALTEILCHENDICHTEN UND TEMPERATUREN DER UNTEREN THERMOSPHAERE IN POLAREN BREITEN UND WINTERBEDINGUNGEN]
G. Schneppe Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Sep. 1972 99 p refs In GERMAN; ENGLISH summary
(Contract WRK-170)
(BMBW-FB-W-72-29) Avail: NTIS HC $7.00; ZLDI, Munich 20,40 DM

ESRO payloads, S61-1 and -2 were launched near Kiruna (68 deg N) on 25 February, 1970 at 17.33 CET and on 26 February, 1970 at 05.47 CET, respectively. In both payloads, a monopole mass spectrometer was used to measure the neutral air density and composition of the lower thermosphere. Measurements of N2 -, Ar-, and He-number densities as well as the derived temperature profiles are presented. The n (O2)-profile is strongly influenced by recombination of O. In general the results are in satisfactory agreement with current ideas about the properties of the upper atmosphere at polar latitudes in winter time. Author (ESRO)

N73-31372# European Space Research Organization, Paris (France).
DIRECTORY OF EUROPEAN ACTIVITIES IN THE REMOTE SENSING OF EARTH RESOURCES

May 1973 207 p
(ESRO/JPPC-73-20-add-1) Avail: NTIS HC $12.50

European earth resources survey programs using remote sensing methods are listed. Also included is a summary providing a comparative assessment of remote sensing activities since the first edition published in November 1971. ESRO

N73-31373# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
ON THE NUMERICAL DETERMINATION OF PARTICLE SIZE DISTRIBUTION IN A COAGULATING AEROSOL
D. H. Ferriss May 1973 17 p refs
(NPL-NAC-35) Avail: NTIS HC $3.00

A computer program for the numerical solution of a nonlinear integro-differential equation representing a mathematic model of a coagulating aersol was developed. The mathematical statement of this problem is given, and the numerical methods employed from its solution described. Author

N73-31374# Army Foreign Science and Technology Center, Charlottesville, Va.
OPTICAL CHARACTERISTICS OF ATMOSPHERIC AEROSOLS IN THE NEAR INFRARED REGION OF THE SPECTRUM
S. D. Andreev, L. S. Ivlev, and E. L. Yanchenko 19 Jul. 1973 16 p refs Transl. into ENGLISH from Probl. Fiz. Atmosfery (USSR), no. 9, 1971 p 48-58
(AD-764135; FSTC-HT-23-2478-72) Avail: NTIS CSCL 04/1

The author discusses the behavior of the aerosol attenuation coefficient in the near infrared region of the spectrum and its relation to the conditions under which the experiment was carried out. GRA

N73-31375# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
A GEOMETRIC INVESTIGATION OF THE EFFECT OF VIEWING ANGLE ON THE GROUND RESOLUTION OF SATELLITE-BORNE SENSORS
Louis D. Duncan Ft. Monmouth, N. J. ECOM Jul. 1973 20 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-764246; ECOM-5502) Avail: NTIS CSCL 08/2

A system of equations has been developed to determine the area (ground resolution) on the surface of the earth observed by a satellite-borne sensor. These equations were used to investigate the relative change in ground resolution for a sensor viewing at other than the subsatellite point. Computations were performed for various values of satellite altitude, viewing angle, and field of view of the sensor. Selected results are presented in graphic and tabular form. Results indicate that, for a fixed satellite altitude, the relative change in ground resolution is a function primarily of the viewing geometry, with only minor dependence upon the size of the field of view. Author (GRA)

N73-31376# Army Engineer Topographic Labs., Fort Belvoir, Va.
ON THE THERMAL NATURE AND SENSING OF SNOW-COVERED ARCTIC TERRAIN
Ambrose O. Poulin May 1973 189 p refs
(DA Proj. 4A0-61102-B-520)
(AD-764239; ETL-RN-73-4) Avail: NTIS CSCL 08/6

Thermal infrared imagery (8 to 14 micrometers) of selected areas of the North American Arctic above the 75th parallel was obtained at three different periods: early winter, midwinter and early spring. Data runs totaling approximately 2500 nautical miles in length were made at altitudes ranging from 1000 to 20,000 feet. Environmental conditions included: (1) daytime with solar altitudes from 2 to 27 degrees and the atmosphere ranging from very clear to very hazy, and (2) very clear to very hazy conditions during the dark season. Subjects covered included sea ice, coastal areas, inland areas, lakes, streams, glaciers, the Greenland Ice Cap, and the Ward-Hunt Ice Shelf. Questions arising from analysis of the imagery led to a winter experiment in which study was concentrated on the temperature differences that develop at shorelines, but a number of secondary studies were also conducted. Aerial radiometric data and photographs were correlated with ground data which included subsurface temperatures in the soil, ice, and snow on both sides of a shoreline. A classification system for thermal features exhibited by arctic terrain and preliminary criteria for seasonal maps was developed. (Modified author abstract) GRA

N73-31377# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF A THEORETICAL MODEL TO VELOCITY FIELDS OBSERVED OVER WATER WAVES M.S. Thesis
Barry C. Stauffer Mar. 1973 61 p refs
(AD-764196) Avail: NTIS CSCL 04/2

A theoretical model is developed for the wind velocity field in the atmospheric near-water layer above ocean waves. A turbulent exchange coefficient due to the wave-caused velocity fluctuations is introduced into the equations to account for the corresponding turbulent nature of the motion and the resulting energy fluxes. The equations of motion for air are derived in a manner to allow for variation of the turbulent exchange coefficient with height. A stream function is introduced and a numerical solution obtained by use of the Richtmyer method. The profiles of wave-caused Reynolds stresses and their resulting energy transfers are discussed and compared with observational data. Author (GRA)

N73-31378# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
PROFILE INVERSION TECHNIQUE FOR THE DETERMINATION OF ELECTRON DENSITY FROM WAVE INTERACTION DATA
Stephen Paul Dale 2 Jul. 1973 76 p refs
(Contract N00014-67-A-0385-0014; Grant NSF GA-13885)
(AD-764297; PSU-IRL-SCI-417) Avail: NTIS CSCL 04/1

The wave interaction experiment is described and the development of the complex coefficient of interaction is reviewed. A numerical technique to solve the wave interaction equations for electron density is then presented. Briefly, the wave interaction equations, for both delta and finite pulse widths, are written in matrix form and then an over determination scheme is applied to reduce the undesirable effects of noisy data. The technique is critically tested, using both theoretical and experimental data, and is shown to be practical for routine use. Author (GRA)

N73-31379# General Electric Co., Philadelphia, Pa. Space Div.
DEFENSE NUCLEAR AGENCY REACTION RATE HANDBOOK. SECOND EDITION. REVISION NO. 1
M. H. Bortner and T. Baurer Nov. 1972 77 p refs
(Contract DASA01-70-C-0082; DASA01-71-C-0145)
(AD-764303; DNA-1948H) Avail: NTIS CSCL 04/1

Discussed is the new mean atmosphere which has been developed for the altitude range 24 to 500 km. Tables are given for various parameters in the atmosphere of interest to the study. GRA

N73-31380# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
ANOTHER METHOD FOR CALCULATING MAGNETIC ANOMALIES Interim Report
R. L. Parker, J. D. Mudie, and R. S. Howard 12 Mar. 1973 15 p refs
(Contract N00014-69-A-0200-6002; Grant NSF GA-31377; NR Proj. 260-103)
(AD-762532; SIO-REF-73-2; MPL-U-17/73) Avail: NTIS CSCL 08/10

The great success of the Vine-Matthews hypothesis in explaining magnetic observations at sea has led to the development of many computer programs for calculating the fields caused by two-dimensional block models. In this note the formulas for the fields due to a uniformly magnetized, two-dimensional body with an arbitrary polygonal boundary are derived. Using this formulation, a sample calculation is given, with a variable observation height. The formulation is somewhat shorter than the best-known previous derivations and allows the inclusion of a variable bottom topography. GRA

N73-31381# Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.
VEGETATION CANOPY REFLECTANCE MODELS Final Report, 1 Jul. 1971 - 30 Jun. 1973
Robert E. Oliver and James A. Smith Jun. 1973 93 p refs

(Grant DA-ARO(D)-31-124-71-G165)
(AD-763222; AROD-9928-2-EN) Avail: NTIS CSCL 08/6

Stochastic and deterministic approaches to simulating the spectroreflectance of shortgrass prairie vegetation have been investigated. The stochastic approach uses randomly selected variates for incoming light flux, plant geometry, and intrinsic optical properties whereas the deterministic model is patterned after the familiar Kubelka-Munk theory for diffuse reflectance. The model results are compared with field and laboratory measurements of Blue grama (Bouteloua gracilis) and successfully predicts the non-Lambertian character of the canopy. The site of the field measurements was the Pawnee National Grasslands, the intensive study site of the International Biological Program. Direct solar and diffuse sky irradiance and the optical properties of Blue grama were measured in the 0.4 micrometer to 1.05 micrometers region of the spectrum using a field adapted EG and G spectroradiometer with a computer based digital acquisition system. Canopy geometry was measured with a laboratory photographic technique with subsequent digitization of the profile images. (Modified author abstract) GRA

N73-31382# Earth Satellite Corp., Washington, D.C.
LAND USE CHANGE AND ENVIRONMENTAL QUALITY IN URBAN AREAS: SOME COMPARATIVE STUDIES
David S. Simonett, William G. Brooner, DeLanne Conte, Darryl R. Goehring, and James L. Haynes 30 Apr. 1973 304 p refs
(Contract ; EQC-306)
(PB-220742/1) Avail: NTIS HC $9.00 CSCL 13B

Characteristics and rate of changes were studied in land use in several urban areas and in particular, in floodplains and wetlands. The land use changes are studied in Denver, Los Angles, San Bernardino-Riverside, Baltimore, and Kansas City. GRA

N73-31383# Texas A&M Research Foundation, College Station.
TNE NON-LINEAR TRANSIENT RESPONSE TO A CONTINUOUSLY STRATIFIED BAROCLINIC OCEAN TO STATIONARY AND TRANSITORY AXIALLY-SYMMETRIC ATMOSPHERIC CYCLONES Annual Report, 20 Sep. 1971 - 19 Sep. 1972
Kent D. Gilbert Mar. 1973 250 p refs
(Contract DAAB07-68-C-0073; DA Proj. 1T1-14501-B-81A)
(AD-763930; A/M-Ref-72-10T; ECOM-0073-68-6; AR-5) Avail: NTIS CSCL 08/3

Considered in the present study is the temporal and spatial theoretical description of circulation and mixing of sea water induced in an initially motionless, continuously stratified, uniformly rotating, baroclinic ocean by steady as well as transitory, axisymmetric, cyclonic atmospheric vortices. Solutions are obtained for the ocean's response to two basically different circular wind fields, namely: (1) a stationary wind field which is applied suddenly and sustained for a designated time interval to permit suddenly initiated oceanic spin-up circulation and mixing, and is subsequently removed abruptly to allow a suddenly initiated oceanic spin-down process; (2) a transitory wind field which is applied gradually (in sinusoidal fashion), to permit a gradual oceanic spin-up and subsequent gradual oceanic spin-down. Generated ocean circulation and mixing is investigated in detail, as well as the energetics for the responses to both wind regimes. (Modified author abstract) GRA

N73-31384# Geological Survey, Washington, D.C. Topographic Div.
RESEARCH AND DEVELOPMENT IN TOPOGRAPHIC MAPPING Annual Report, 1973
Apr. 1973 72 p refs
(PB-221469; USGS-TD-73-001) Avail: NTIS HC $4.50 CSCL 08B

The annual report, covering the 12-month period ending in April 1973, summarizes the research and development activities of the U. S. Geological Survey. Topographic Division in the Office of Research and Technical Standards and in the Region offices at Arlington, Va., Rolla, Mo., Denver, Colo., and Menlo Park, Calif. The R and D projects mentioned concern the fields of cartography, field surveys, photogrammetry, orthophotomapping, and space technology. Articles by Division personnel prepared for presentation at meetings and conferences or for publication in professional journals and the Manual of Topographic Instructions are also listed. GRA

N73-31385# McDonnell Aircraft Co., St. Louis, Mo. Reconnaissance Lab.
AERIAL SURVEILLANCE SPILL PREVENTION SYSTEM
C. L. Rudder, C. J. Reinheimer, and J. L. Berrey Aug. 1972 117 p
(Contract EPA-68-01-0140)
(PB-221484/9; EPA-R2-72-007; W73-11326) Avail: NTIS MF $1.45; SOD HC $3.00 as EPI.23/2:72-007 CSCL 13B

An aerial surveillance system, was evaluated for the remote detection of both real and potential spills threatening inland waterways. Twenty-three multiband and baseline missions were flown over oil refineries and other industrial sites located adjacent to the Mississippi River. Baseline flights were effective in counting storage tanks, locating and identifying storage equipment and pipeline systems and determining dike conditions. Stereoscopic analysis of baseline imagery was used to estimate the height of tanks and dikes, drainage patterns and the area of openly stored waste products. The multiband imagery was obtained by combining each of nine filters with each of three different black and white films. Spectral contrast image enhancement was accomplished by either suppressing or transmitting the target reflected radiation through proper film/filter selections. Spills, effluents and waste areas were hence identified on the multiband imagery. Finally the personnel, equipment and procedures required to implement an aerial surveillance spill prevention system were determined. (Modified author abstract) GRA 0

N73-31386# Oregon State Univ., Corvallis. School of Oceanography.
HYDROGRAPHIC, CHEMICAL AND OPTICAL OBSERVATIONS FROM LEGS 4 AND 5, YALOC-71
William S. Plank, James J. Anderson, and Hasong Pak May 1973 388 p refs
(Contract N00014-67-A-0369-0007; NR Proj. 083-102)
(AD-763591; Data-54; Ref-73-7) Avail: NTIS CSCL 08/10

Hydrographic, chemical and optical data collected on legs 4 and 5 (November and December, 1971) of YALOC-71 in the vicinity of the Panama Basin are presented. The measurements were made for two purposes -- to study the behavior of the Cromwell Current near the Galapagos Islands and to study the suspended particulate matter in the Panama Basin. Author (GRA)

N73-31387# Washington Univ., Seattle. Div. of Marine Resources.
ARCTIC ICE DYNAMICS JOINT EXPERIMENT
Feb. 1973 113 p refs
(Grant NSF C-625)
(PB-221714/9; AIDJEX-Bull-18) Avail: NTIS HC $3.00 CSCL 08L

Oceanographic experiments were conducted during the 1971 AIDJEX pilot study to determine ice motion and interior flow field. The under-ice diving experiment was carried out during the 1972 pilot study. The AIDJEX field operations during fall 1972, and an experiment in mapping the underside of sea ice by backscattered sound are summarized. GRA

N73-31388# Washington Univ., Seattle. Div. of Marine Resources.
ARCTIC ICE DYNAMICS JOINT EXPERIMENT: AIDJEX BULLETIN
May 1973 168 p refs
(Grant NSF C-625)
(PB-222057/2; AIDJEX-Bull-20) Avail: NTIS HC $3.00 CSCL 08L

The work evaluates the methods available for predicting air stress for a synoptic-scale ice dynamics model. Also included are a data management report on the 1972 AIDJEX pilot study and an index to the contents of past bulletins. GRA

N73-31389# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
INFRARED RADIOMETRY AND AIR/SEA INTERACTION STUDIES Final Report, 10 Nov. 1971 - 9 Mar. 1973

Theodore D. Foster and Stephen Rearwin 1973 6 p refs
(Contract N00014-69-A-0200-6032)
(AD-763788) Avail: NTIS CSCL 08/10

The report describes research conducted on improving and evaluating an airborne two-wavelength radiometer to make direct measurements of the sea-surface temperature and the total heat flux through the sea surface. GRA

N73-31390# Naval Academy, Annapolis, Md. Dept of Environmental Sciences.
OCEANIC RANDOM MOTION, A STATE OF THE ART REVIEW
Jerome Williams May 1973 62 p refs
(AD-763804) Avail: NTIS CSCL 08/3

The present knowledge regarding random oceanic motion is summarized. For convenience random motion is divided into turbulence, surface waves, and internal waves. The characteristics of these phenomena are examined along with some of the basic assumptions usually made to simplify their study. In particular, the validity of the usual assumptions of isotropy and stationarity are questioned. The difference between field and laboratory results is indicated, and the shortcomings of laboratory studies are emphasized. Experimental results in certain areas are reviewed to show reasonable approximations to presently accepted theory. Energy sources such as the wind and tide are relatively easy to pinpoint, but other sources giving rise to inertial period fluctuations and seiching are somewhat more difficult to explain. The relationship between the amount of energy contained in turbulent flow as compared to that in the mean flow also varies widely. (Modified author abstract) GRA

N73-31391# Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
A MULTIPURPOSE INTERNAL WAVE FACILITY
Donald M. Sheppard, Omar H. Shemdin, and Yu. H. Wang Jun. 1973 71 p refs
(Contract N00014-68-A-0173-0015; Grant NSF GK-3120; NR Proj. 062-449)
(AD-763444; TR-19) Avail: NTIS CSCL 08/3

The need for a better understanding of internal waves has increased in recent years as a result of increased interest in the sea. Questions regarding the precise mechanism by which these waves are generated remain to be answered, even though a number of well formulated theories have been advanced. The need for quantitative experiments to reinforce or repudiate these theories is evident. The facility described in this report was designed and constructed to help fulfill this need. The facility consists of a versatile internal wave tank 116.5 ft long x 7.5 ft high x 2 ft wide, a 60 hp pump, a variable pitch axial flow fan and a servo-hydraulic mechanical surface and internal wave generator system. Mechanical waves can be generated at the interface between two liquid layers and at the surface of the upper layer. Shear flows can be obtained by pumping either of the two layers or by blowing air over the upper layer. Wind generated surface waves can also be obtained with the fan. This report describes the facility, presents calibration data, outlines the available instrumentation and discusses briefly some of the research to be performed. (Modified author abstract) GRA

N73-31571 Joint Publications Research Service, Arlington, Va.
UTILIZATION OF THE METHOD OF INVERSE SCATTERING TO MEASURE THE TRANSPARENCY OF THE ATMOSPHERE IN THE SLANT DIRECTION
Ye. N. Dovgyallo, V. A. Kovalev, and Ye. A. Polyakova *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 69-76 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 56-61 (For availability see N73-31565 22-20)

N73-31572 Joint Publications Research Service, Arlington, Va.
PROBLEM OF CALCULATING THE THICKNESS OF THE QUASIUNIFORM LAYER OF THE OCEAN
I. N. Rusin *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 77-86 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 62-69 (For availability see N73-31565 22-20)

N73-31856 National Research Council of Canada, Ottawa (Ontario). Hydraulics Lab.
BED FORMS GENERATED BY WAVE ACTION
G. R. Mogridge *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 21-41 refs (For availability see N73-31853 22-34)

N73-31900* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATIONS, OVERVIEW
William Nordberg *In its* Significant Accomplishments in Sci. 1973 p 161-177 (For availability see N73-31867 22-34)
CSCL 08E

N73-31901* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MAPPING WITH ERTS-1
James R. Greaves *In its* Significant Accomplishments in Sci. 1973 p 178-181 (For availability see N73-31867 22-34)
CSCL 08B

N73-31902* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF SEA ICE MOTION
Albert Rango *In its* Significant Accomplishments in Sci. 1973 p 182-186 ref (For availability see N73-31867 22-34)
CSCL 08L

N73-31904* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEANIC TURBIDITY AND CHLOROPHYLL AS INFERRED FROM ERTS-1 OBSERVATIONS
Robert J. Curran *In its* Significant Accomplishments in Sci. 1973 p 190-192 (For availability see N73-31867 22-34)
CSCL 08J

N73-31905* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF THE ATMOSPHERE ON ERTS OBSERVATIONS
Robert S. Fraser *In its* Significant Accomplishments in Sci. 1973 p 193-195 (For availability see N73-31867 22-34)
CSCL 04A

N73-31906* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE OBSERVATIONS DURING THE RAPID INTENSIFICATION OF HURRICANE CAMILLE
William E. Shenk *In its* Significant Accomplishments in Sci. 1973 p 196-200 (For availability see N73-31867 22-34)
CSCL 04B

N73-31908* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIDES IN THE UPPER ATMOSPHERE: A CONTROVERSY RESOLVED?
John S. Theon *In its* Significant Accomplishments in Sci. 1973 p 205-208 (For availability see N73-31867 22-34)
CSCL 04A

N73-31909* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH PHYSICS, OVERVIEW
Friedrich O. VonBun *In its* Significant Accomplishments in Sci. 1973 p 211 (For availability see N73-31867 22-34)
CSCL 08E

N73-31910* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DETAILED GRAVIMETRIC GEOID OF NORTH AMERICA, THE NORTH ATLANTIC, EURASIA, AND AUSTRALIA
James G. Marsh *In its* Significant Accomplishments in Sci. 1973 p 212-215 (For availability see N73-31867 22-34)
CSCL 08N

N73-31911* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MOTION
Ronald Kolenkiewicz *In its* Significant Accomplishments in Sci. 1973 p 216-219 (For availability see N73-31867 22-34)
CSCL 08E

N73-31912* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ORIGIN OF INTERMEDIATE AND DEEP FOCUS EARTHQUAKES
Han-Shou Liu *In its* Significant Accomplishments in Sci. 1973 p 220-223 (For availability see N73-31867 22-34)
CSCL 08E

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-31392 British Broadcasting Corp., Kingswood (England). Research Dept.
AN AUTOMATED SHOT-CHANGE DETECTOR FOR TELECINE
J. R. Sanders and M. Weston Jul. 1973 10 p refs
(BBC-RD-1973/10; PH-109) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A system for the detection of shot changes occuring in films reproduced by telecine was developed. This information is required for pre-programmed systems of telecine control and was, in the past, always obtained by visual inspection of the film in order to make a record, usually on paper tape, of the positions in the film at which shot changes occurred. The detector described eliminates the need for visual inspection of film and is being used to effect a useful saving in the time and cost of preparing preprogrammed correction information. Author

N73-31393 Tennessee Univ., Knoxville.
A THEORETICAL COMPARISON OF TWO METHODS FOR TIMING WITH SURFACE BARRIER DETECTORS Ph.D. Thesis
Elwin Eldridge Gross, Jr. 1972 154 p
Avail: Univ. Microfilms Order No. 73-12408

Timing, or time spectroscopy, in nuclear instrumentation involves the precise measurement of elapsed time between two events, or the isolation of true coincidence events from a background of noncoincident data. The purpose of this investigation was to make a theoretical comparison of two methods for timing with surface-barrier detectors. A variety of surface-barrier detectors were exposed to 5.5 MeV alpha particles and the resulting pulses of current were measured. The output current pulses could usually be described as either rectangular in shape or as a decaying exponential. Mathematical models for both types of current pulses were used in an analysis of the amplitude and rise time compensated (ARC) timing system. Theoretical expressions for the slope of the signal at the output terminal of the ARC circuit were developed. Dissert. Abstr.

N73-31394 Kansas Univ., Lawrence.
ANALYSIS OF S193 MICROWAVE RADIOMETER SCATTEROMETER FOR SKYLAB Ph.D. Thesis
Walter Robert Hanley 1972 538 p
Avail: Univ. Microfilms Order No. 73-11890

A detailed evaluation and suggested modification are provided here for the radiometer-scatterometer system (designated S193) which is to be flown on Skylab A. The S193 combines a radiometer, scatterometer, and altimeter into an integrated system. The system is proposed as part of the instrumentation package required for the execution of Earth Resources Experiments on-board the Skylab A space vehicle. The capabilities and limitations on the configuration being implemented are assessed. Several recommendations have been made for configuration changes, and some of them have been incorporated into the system design. Others, due to hardware commitments, development requirements, cost or program schedule, have not been incorporated in the present design for S193; however, they should be considered in future designs. Dissert. Abstr.

N73-31395 Washington Univ., St. Louis, Mo.
THEORY AND APPLICATION OF REMOTE SENSORS IN AIR POLLUTION ENGINEERING Ph.D. Thesis
Homer Wendell Hiser 1972 173 p
Avail: Univ. Microfilms Order No. 73-11813

The basic principles of both active and passive remote sensors are presented, and signature concepts for identifying and measuring specific air pollution parameters are discussed. Radar systems are described and the equations are given for applying them. A radar is designed on the basis of these equations for detection and measurement of particulates. A method is presented for extracting thermal stability, humidity, and turbulence data in the lower atmosphere from temporal changes in radar reflections from stationary objects. Methods for estimating washout by precipitation and for measuring wind, turbulence, and temperature by direct and induced radar backscatter are outlined. Passive infrared, visible, and ultraviolet spectroscopic instruments for identifying and measuring gaseous pollutants also are described and evaluated. Dissert. Abstr.

N73-31396# Joint Publications Research Service, Arlington, Va.
SELECTED ARTICLES ON SOVIET MAGNETOMETRY
1 Aug. 1973 25 p refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 50, 1972
(JPRS-59674) Avail: NTIS HC $3.25

Research is reported on a helium self-oscillating magnetometer with optical pumping of He-4 atoms, the possibilities of using differential magnetometers with mobile base, parameters and errors of magnetically sensitive elements of a ferrosonde gradiometer, and compensation of static fields of ferrosonde magnetometer carrier. For individual titles, see N73-31397 through N73-31400.

N73-31397 Joint Publications Research Service, Arlington, Va.
HELIUM SELF-OSCILLATING MAGNETOMETER WITH OPTICAL PUMPING OF He24 ATOMS
R. A. Zhitnikov, P. P. Kuleshov, N. A. Dovator, and V. A. Azin *In its* Selected Articles on Soviet Magnetometry (JPRS-59674) 1 Aug. 1973 p 1-5 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 50, 1972 p 5-9 (For availability see N73-31396 22-14)

The design of the magnetometer is described along with its operational characteristics. The results or preliminary studies are presented which indicate that the helium-type self-oscillating magnetometer is not inferior in sensitivity to the familiar quantum magnetometer, and it possesses a number of advantages for broad application in scientific investigations. D.L.G.

N73-31398 Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USING DIFFERENTIAL MAGNETOMETERS WITH MOBILE BASE
R. B. Semevskiy *In its* Selected Articles on Soviet Magnetometry (JPRS-59674) 1 Aug. 1973 p 6-11 ref Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 50, 1972 p 14-19 (For availability see N73-31396 22-14)

The possibility is examined of utilizing gradiometers for measuring the constant magnetic field of the earth, its variations through time, and the absolute travel speed of the equipment carrier. Author

N73-31399 Joint Publications Research Service, Arlington, Va.
PARAMETERS AND ERRORS OF MAGNETICALLY SENSITIVE ELEMENTS OF FERROSONDE GRADIOMETER
V. F. Vefremov *In its* Selected Articles on Soviet Magnetometry (JPRS-59674) 1 Aug. 1973 p 12-17 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 50, 1972 p 42-47 (For availability see N73-31396 22-14)

The design requirements are examined for the magnetically sensitive elements (MSE) of a ferrosonde gradiometer for use in measuring the gradient of magnetic field strength. Particular emphasis is placed on the identity of the electric and magnetic parameters of its half-cells. A design is suggested for an MSE in a ferrosonde-type gradiometer which eleminates the appearance of errors linked with the nonparallelism of the half-cells' magnetic

axes. To exclude the errors in the proposed MSE, it is necessary to obtain identical amplitude and phase responses of the half-cells. This is achieved by regulating the input signals with the aid of small varistors connected in series with the measuring windings. D.L.G.

N73-31400 Joint Publications Research Service, Arlington, Va.
COMPENSATION OF STATIC FIELDS OF FERROSONDE MAGNETOMETER CARRIER
Yu. M. Osipov *In its* Selected Articles on Soviet Magnetometry (JPRS-59674) 1 Aug. 1973 p 18-23 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 50, 1972 p 47-52 (For availability see N73-31396 22-14)

The methods are examined which are used to compensate for the magnetic interference with a ferrosonde magnetometer mounted on a mobile carrier. The interference is caused by the carrier's magnetic masses and usually compensated either by a system of rings with constant current or by permanent magnets. Although the system of rings provides a greater uniformity of compensation, the method has many disadvantages. Emphasis is placed on method utilizing permanent magnets. A mathematical procedure is outlined for positioning the compensation magnets. D.L.G.

N73-31401*# Martin Marietta Corp., Orlando, Fla. Advanced Technology Dept.
TEMPERATURE MEASUREMENT SYSTEM Patent Application
Forest C. Deal, inventor (to NASA) Filed 14 Feb. 1973 11 p Sponsored by NASA
(NASA-Case-MFS-20781-2; US-Patent-Appl-SN-332529) Avail: NTIS HC $3.00 CSCL 14B

Systems for the measurement and control of fairly high temperatures are described, particularly the measurement of the temperature of welds. The control of welding equipment to heat materials to be welded, in accordance with a desired temperature-time profile, is also discussed. The basic novelty of the invention lies in the separate detection of discrete bands of infrared radiation from the object or objects being heated and then computing the ratio of the magnitudes of these bands. In this way a true indication of temperature is obtained which does not depend upon the magnitude of radiation sensed and is thus a more accurate system of temperature measurement. A second aspect of the invention is the use of stored IR temperature-time profile data from previous successful test welds for control of the system. NASA

N73-31402# Australian Post Office Research Labs., Melbourne.
AUTOMATIC SPEECH LEVEL METER
G. T. Martin Sep. 1972 31 p refs
(Rept-6648) Avail: NTIS HC $3.75

A description is given of the design and operation of the automatic speech level meter. A brief summary is presented of computer programs available to process the output tape and operating instructions for running the programs are also given. The instrument is designed to measure signal levels on a voice frequency telephone circuit by sampling the instantaneous signal voltage approximately four times per second, then logarithmically quantising and coding the sampled value and recording it on punched paper tape. The paper tape is computer processed to produce results which statistically characterise the signal amplitude distribution. A control unit allows the speech level meter to automatically operate when a telephone call is established, and measure speech flowing in one direction only on a two-wire circuit. Author

N73-31403# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
THE GYRO PLASMA PROBE ONBOARD THE REXS-DENPA SATELLITE
Masaki Ejiri, Hiroshi Oya, Takehiko Aso, Cozo Morita, Tatsuzo Obayashi, Shinji Urimoto, and Hiroyuki Yamaki Jul. 1973 116 p refs
(ISAS-495-Vol-38-No-6) Avail: NTIS HC $8.00

The swept frequency impedance probe IPS, which is designed to measure ionospheric plasma parameters, has been installed on the REXS-DENPA satellite (1972-064A). The IPS consists of an impedance measuring equipment, automatic sample-detection sub-systems and 2 m antenna as a sensor immersed in space plasma. The impedance measuring equipment is known as the gyroplasma probe. Various plasma resonance frequencies are detected and antenna impedance values at several frequencies are measured. Those digitalized data are fed to PCM telemetry through a data sampling system. Preliminary results obtained for a period of three-days observation are summarized for the following items; (1) electron density profiles in the topside ionosphere over the sub-tropical latitudes, (2) mean ion composition in the topside ionosphere and (3) the antenna potential control effect due to photoemission from metallic antenna surface. Author

N73-31404# Joint Publications Research Service, Arlington, Va.
PHOTOELECTRONIC AND THERMOELECTRONIC INSTRUMENTS AND THEIR APPLICATIONS
S. V. Mayorov 4 Sep. 1973 25 p refs Transl. into ENGLISH from the pamphlet "Fotoelektronnyye i Termoelektronnyye Pribory i ikh Primeneniye" Moscow, Mashinostri., 1973 21 p
(JPRS-59951) Avail: NTIS HC $3.25

Descriptions are presented of the design and physical principles of operation of various photoelectronic and thermoelectronic instruments including multipliers, transmitting television tubes and image converters. Author

N73-31405*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PIONEER 11 HIGH-FIELD FLUXGATE MAGNETOMETER
M. H. Acuna and N. F. Ness Sep. 1973 73 p refs Submitted for publication
(NASA-TM-X-70467; X-692-73-268) Avail: NTIS HC $3.25 CSCL 14B

The High Field Fluxgate Magnetometer Experiment flow aboard the Pioneer 11 spacecraft to investigate Jupiter's magnetic field is described. The instrument extends the spacecraft's upper limit measurement capability by more than an order of magnitude to 17.3 gauss with minimum power and volume requirements. Author

N73-31406*# Louisiana State Univ., Baton Rouge. Dept. of Physics and Astronomy.
MONTE CARLO SIMULATION OF THE NUCLEAR-ELECTROMAGNETIC CASCADE DEVELOPMENT AND THE ENERGY RESPONSE OF IONIZATION SPECTROMETERS Final Report, 1 Jul. 1970 - 30 Jun. 1973
W. V. Jones 29 Jun. 1973 18 p refs
(Contract NAS9-10986)
(NASA-CR-133999) Avail: NTIS HC $3.00 CSCL 14B

Modifications to the basic computer program for performing the simulations are reported. The major changes include: (1) extension of the calculations to include the development of cascades initiated by heavy nuclei, (2) improved treatment of the nuclear disintegrations which occur during the interactions of hadrons in heavy absorbers, (3) incorporation of accurate multi-pion final-state cross sections for various interactions at accelerator energies, (4) restructuring of the program logic so that calculations can be made for sandwich-type detectors, and (5) logic modifications related to execution of the program. D.L.G.

N73-31407# National Bureau of Standards, Washington, D.C. Metallurgy Div.
THE DIVERGENT BEAM (KOSSEL) X-RAY METHOD AND ITS USES IN MEASURING STRAIN CONTOURS IN AN INDIVIDUAL GRAIN OF Fe-3 WEIGHT PERCENT Si TRANSFORMER SHEET Final Report
Harvey Yakowitz Aug. 1973 80 p refs
(NBS-Monograph-130; LC-72-600265) Avail: SOD HC $0.95 as C13.44:130

The application of a divergent beam (Kossel) X-ray microdiffraction technique for measuring the residual and impressed stresses and strains in an iron-silicon alloy transformer sheet is discussed. The maps are roughly analogous to polarized light stress analysis of transparent materials. It was determined that a variable strain distribution existed in the alloy sheet at the

time it was ready for insertion into a transformer core. Small applied compressive and tensile loads tended to rearrange this variable strain distribution but not to appreciably alter the total stored elastic energy. Author

N73-31408*# Perkin-Elmer Corp., Norwalk, Conn.
STELLAR FIGURE SENSOR Final Report, Jan. 1972 - Jan. 1973
William N. Peters Apr. 1973 112 p refs
(Contract NAS5-23067)
(NASA-CR-132795; Rept-11455) Avail: NTIS HC $7.75 CSCL 20F

A compilation of analytical and experimental data is presented concerning the stellar figure sensor. The sensor is an interferometric device which is located in the focal plane of an orbiting large space telescope (LST). The device was designed to perform interferometry on the optical wavefront of a single star after it has propagated through the LST. An analytical model of the device was developed and its accuracy was verified by an operating laboratory breadboard. A series of linear independent control equations were derived which define the operations required for utilizing a focal plane figure sensor in the control loop for the secondary mirror position and for active control of the primary mirror. D.L.G.

N73-31409*# Martin Marietta Corp., Orlando, Fla.
GROUND STATION HARDWARE FOR THE ATS-F MILLIMETER WAVE EXPERIMENT Final Report
Terry L. Duffield Feb. 1973 306 p refs
(Contract NAS5-21525)
(NASA-CR-132802; OR-12395) Avail: NTIS HC $17.50 CSCL 14B

The results are presented of a program to design, fabricate, test, and install a primary ATS-F millimeter wave ground receiving station. Propagation parameters at millimeter waves are discussed along with the objective of the overall experiment. A general description is given of the receiving system and its function in the experiment. Typical receiver characteristics are presented which show that the experiment is entirely feasible from a link SNR standpoint. The receiving system hardware designs are discussed with separate treatment given to the propagation and the radiometer receiver designs. The modification and relocation are described of an existing 15-ft antenna to meet the ATS-F requirements. The design of a dual frequency feed subsystem and self calibration equipment is included. D.L.G.

N73-31410*# Kanner (Leo) Associates, Redwood City, Calif.
AGFACONTOUR: A NEW FILM FOR SIMPLIFIED PRODUCTION OF EQUIDENSITIES
E. Ranz Washington NASA Sep. 1973 28 p Transl. into ENGLISH of unpublished DFVLR report, Jun. 1973 21 p
(Contract NASw-2481)
(NASA-TT-F-15112) Avail: NTIS HC $3.50 CSCL 14E

In the Agfacontour film, a new photographic material has been developed which will rapidly and directly reproduce the equidensities of an original. A normal cycle of photographic processing is sufficient. In addition, the position of equidensities and the extent of density covered by equidensities can be well regulated within wide limits. The film can be used both in pictorial and techno-scientific photography. In particular, the techno-scientific applications of the Agfacontour film are considerable. Author

N73-31411*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
ADVANCED APPLICATIONS FLIGHT EQUIPMENT (AAFE) 125mm ULTRAVIOLET SPECTROMETER Final Report
Robert J. Schroeder May 1973 68 p
(Contract NAS1-10388)
(NASA-CR-132266) Avail: NTIS HC $5.50 CSCL 14B

The conceptual work is reported for the 125 mm ultraviolet spectrometer to measure atmospheric ozone as a function of height, latitude, and time. The instrument is described along with the assembly, test, and calibration. F.O.S.

N73-31412*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
QUARTZ CRYSTAL MICROBALANCE CONTAMINATION MONITORS ON SKYLAB: A QUICK LOOK ANALYSIS
R. Naumann, W. Moore, D. Nisen, W. Russell, and P. Tashbar 8 Jun. 1973 21 p
(NASA-TM-X-64778) Avail: NTIS HC $3.25 CSCL 14B

Six quartz crystal microbalance contamination monitors were flown on Skylab to monitor the deposition of material from spacecraft outgassing and from the rendezvous and docking maneuvers of the Command/Service Module. This report contains a quick-look analysis of the data from these units during the unmanned and manned portions of SL2. Author

N73-31413*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE APPLICATION OF HOLOGRAPHY AS A REAL-TIME THREE-DIMENSIONAL MOTION PICTURE CAMERA
Robert L. Kurtz Washington Sep. 1973 18 p refs
(NASA-TR-R-409; M-457) Avail: NTIS HC $2.75 CSCL 20F

A historical introduction to holography is presented, as well as a basic description of sideband holography for stationary objects. A brief theoretical development of both time-dependent and time-independent holography is also provided, along with an analytical and intuitive discussion of a unique holographic arrangement which allows the resolution of front surface detail from an object moving at high speeds. As an application of such a system, a real-time three-dimensional motion picture camera system is discussed and the results of a recent demonstration of the world's first true three-dimensional motion picture are given. Author

N73-31414*# Mead Technology Labs., Dayton, Ohio.
COMPUTER ENHANCEMENT OF RADIOGRAPHS Final Report
A. Dekaney, J. Keane, and J. DeSautels 15 Jul. 1973 85 p refs
(Contract NAS8-28521)
(NASA-CR-124393; MFR-73-3) Avail: NTIS HC $6.25 CSCL 14E

Examination of three relevant noise processes and the image degradation associated with Marshall Space Flight Center's (MSFC) X-ray/scanning system was conducted for application to computer enhancement of radiographs using MSFC's digital filtering techniques. Graininess of type M, R single coat and R double coat X-ray films was quantified as a function of density level using root-mean-square (RMS) granularity. Quantum mottle (including film grain) was quantified as a function of the above film types, exposure level, specimen material and thickness, and film density using RMS granularity and power spectral density (PSD). For various neutral-density levels the scanning device used in digital conversion of radiographs was examined for noise characteristics which were quantified by RMS granularity and PSD. Image degradation of the entire pre-enhancement system (MG-150 X-ray device; film; and optronics scanner) was measured using edge targets to generate modulation transfer functions (MTF). The four parameters were examined as a function of scanning aperture sizes of approximately 12.5 25 and 50 microns. Author

N73-31415*# San Francisco Univ., Calif. Dept. of Physics.
ON PARTICLE TRACK DETECTORS Interim Report No. 27
E. V. Benton, T. A. Gruhn, and C. H. Andrus Jun. 1973 35 p refs
(Contract NAS8-26758)
(NASA-CR-124381) Avail: NTIS HC $3.75 CSCL 14B

Aqueous sodium hydroxide is widely used to develop charged particle tracks in polycarbonate film, particularly Lexan. The chemical nature of the etching process for this system has been determined. A method employing ultra-violet absorbance was developed for monitoring the concentration of the etch products in solution. Using this method it was possible to study the formation of the etching solution saturated in etch products. It was found that the system super-saturates to a significant extent before precipitation occurs. It was also learned that the system approaches its equilibrium state rather slowly. It is felt that both these phenomena may be due to the presence of surfactant in the solution. In light of these findings, suggestions are given regarding the preparation and maintenance of the saturated etch solution. Two additional research projects, involving

automated techniques for particle track analysis and particle identification using AgCl crystals, are briefly summarized. Author

N73-31416*# Florida Univ., Gainesville. Dept. of Mechanical Engineering.
HYDROGEN AND OXYGEN SENSOR DEVELOPMENT Final Report
E. A. Farber, J. Mahig, and H. R. A. Schaeper 31 Oct. 1972 158 p refs
(Contract NAS10-1255)
(NASA-CR-133891) Avail: NTIS HC $10.00 CSCL 14B

A reliable and low cost gas sensor was investigated for instantaneously detecting H2 in N2, H2 in air, and O2 in N2. The major portion of the research was spent in developing a sensor which would instantaneously detect H2 to + or - 50 ppm even in the presence of trace amounts of other gases. The experimental procedures used to provide the performance characteristics for the various oscillators are discussed describing the equipment with help of schematics and photographs where applicable. The resulting performance is given in graphical form. In some cases both hydrogen and helium may be present and since both of them affect gas sensors similarly, a method was found to determine the concentration of each. The methods developed are grouped into the following four broad categories: pure metal response, variation in heat conductivity, reduction methods, and exotic processes. From the above it was decided for the present to use a copper oxide reduction process as this process was demonstrated to be capable of determining the concentrations of hydrogen and helium respectively in a gas mixture with air or nitrogen. Author

N73-31417# Brookhaven National Lab., Upton, N.Y.
EVALUATION OF AN AIRBORNE GAS CHROMATOGRAPH FOR LONG DISTANCE METEOROLOGICAL TRACING
R. N. Dietz, E. A. Cote, and G. J. Ferber (NOAA, Silver Spring, Md.) 1972 7 p refs Presented at 165th Meeting of the Am. Chem. Soc., Dallas, Tex., 8 Apr. 1973
(BNL-17478; Conf-730403-2) Avail: NTIS HC $3.00

The capability of the portable SF6 chromatograph to detect and quantitatively determine the behavior of a plume out to 100 km or more, with a release on the order of 100 kg of SF6, was validated. If used in conjunction with other real-time instruments for pollutants, such as the chemiluminescent NO monitor, the rate of conversion of the pollutant could be rapidly determined as well as the relative contribution of a source to the pollutant level at a distant location. Preliminary indications offer hope that the halocarbons (CF2BR2 and C2F4Br2) tested in this experiment will prove to be feasible long-range tracers. Author (NSA)

N73-31418# Los Alamos Scientific Lab., N.Mex.
LOS ALAMOS FIELD PULSE HEIGHT ANALYZER
R. D. Hiebert, L. J. Johnson, and A. R. Koelle Mar. 1973 8 p refs
(Contract W-7405-eng-36)
(LA-5203-MS) Avail: NTIS HC $3.00

A portable nuclear radiation spectrometer has been designed for rapid field measurement of mixed isotopic contaminants. The instrument can simultaneously accumulate counts in six energy channels. The first application of the spectrometer used a low energy photon scintillation detector, but the instrument can be adapted to other types of detector probes. Author (NSA)

N73-31419# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
OSCILLATION ANEMOMETER
J. Kielbasa (Polish Acad. of Sci., Cracow) 1972 32 p refs In GERMAN; ENGLISH summary
(Rept-9/1972) Avail: NTIS HC $3.75

An oscillation hot wire anemometer based on downstream transit time of a hot volume of gas is described. The probe of the anemometer consists of two parallel thin hot wires, oriented perpendicular to the flow. The flow velocity is in the plane of the two wires. The upstream wire (transmitter) was heated by passing a current through it until the hot spot carried with the flow reached the downstream wire (receiver). At this point, the heating current was interrupted and turned on again when the hot spot left the receiver. The frequency of the resulting oscillation yielded a measure of flow velocity. This method is especially suitable for low flow velocities, down to about 10 cm/s. ESRO

N73-31420# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
TWO-DIMENSIONAL SCHLIEREN METHOD FOR THE INCLINATION DETERMINATION OF VIBRATING SURFACES
K. M. Viering and G. E. A. Meier Aug. 1972 29 p refs In GERMAN; ENGLISH summary
(Rept-10/1972) Avail: NTIS

A device is described which enables the observation of surface vibration angular displacement of elastic media, based on two dimensional image forming schlieren techniques. The vibrating diaphragm with reflecting sections was irradiated by a light beam projected through a lens on two separate image planes by means of a beam splitter working as an orthogonal pair of wedges. Angular displacement of light reflecting plane surface sections produce variations in intensity at two corresponding image locations. Each intensity depends only on one directional component of angular displacement and is represented as an electric signal by a photoelectric element. This method has been successfully tried out by recording static characteristic curves and by application to a water channel flow. ESRO

N73-31421# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
A TELESCOPE FOR SOFT GAMMA RAY ASTRONOMY
V. Schoenfelder, A. Hirner, and K. Schneider Nov. 1972 39 p refs Submitted for publication
(MPI-PAE/Extraterr-74) Avail: NTIS

A gamma ray telescope using the double Compton process is described, along with extraterrestrial gamma ray fluxes in the energy range 1-10 MeV. The detector consists of two large plastic scintillator blocks, 1.20 m apart. A gamma ray event is identified by a Compton collision in the upper detector, followed by a second scattering in the lower crystal, the sequence being verified by a time of flight measurement. The properties of the telescope were measured in the laboratory using the gamma ray sources Co-60 and Na-24. The telescope has an opening half angle of 15 deg with an energy resolution of + or - 20% and an absolute detection efficiency of about 0.5%. It has an especially low sensitivity to undesired background gamma rays. A slightly modified version of the telescope will be used in balloon flights to measure the spectrum of diffuse primary gamma rays. Author (ESRO)

N73-31422# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
DETERMINATION OF THE SIGN OF THE VELOCITY COMPONENTS OF THE LASER DOPPLER ANEMOMETER
W. J. Hiller and G. E. A. Meier Oct. 1972 11 p refs In GERMAN
(Rept-1/1972) Avail: NTIS HC $3.00; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. 5,30 DM

A method based on a phase comparison for determining the sign of two differently produced components of the Doppler difference signal is described. The phase shift of the Doppler difference signals is produced by phase rotation of the polarized scattered light. As this method makes use of only passive optical components, its practical application is very uncritical and causes no additional error sources in velocity determination. This method may also be applied to the counting of line orders of other interferometers. It was originally developed for the investigation of density variations in unsteady flows. ESRO

N73-31423# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THE SCATTERED LIGHT COMPARATIVE BEAM ANEMOMETER, A LASER ANEMOMETER FOR THE MEASUREMENT OF THREE VELOCITY COMPONENTS
W. J. Hiller and G. E. A. Meier Jul. 1972 35 p refs In GERMAN; ENGLISH summary
(Rept-3/1972) Avail: NTIS HC $3.75; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. 10,70 DM

A self-aligning reference beam method for simultaneous measurement of three components of flow velocity is described. The characteristic features of this method consist in that both

the reference beam and the object beam are produced by scattering and that the interference takes place in concentric wave systems. Velocity measurements using this method in water and air flows, with He-Ne and argon lasers as light sources, and photodiodes as photodetectors, are described. ESRO

N73-31424# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Abteilung Stroemungen geringer Dichte und hoher Enthalpie.

SIMULATION OF A ROCKET ASCENT IN THE 65 TO 90 km ALTITUDE RANGE FOR PERFORMANCE TEST OF A CRYOCOOLED MASS SPECTROMETER IN THE DFVLR ARC HEATED WIND TUNNEL PK2 [SIMULATION DES AUFSTIEGS EINER RAKETE IM HOEHENBEREICH VON 65 BIS 90 km ZUR FUNKTIONSERPROBUNG EINES KRYOGEKUEHLTEN MASSENSPEKTROMETERS IM DFVLR-PLASMAWINDKANAL PK2]

Klaus Stursberg, Werner Krahn, and Wolfgang Karnatschke 27 Jul. 1972 118 p refs In GERMAN; ENGLISH summary (DLR-MITT-72-23) Avail: NTIS HC $8.00; DFVLR, Porz, West Ger. 31,20 DM

Flow conditions were produced in the arc heated wind tunnel PK2 of the DFVLR, the static data simulating an altitude range between 65 and 90 km and the dynamic part corresponding to the speed variation of the mass spectrometer flying in a ballistic trajectory. The usual shock wave in front of the probe in a supersonic flow was avoided by cooling the probe head with liquid helium. The absence of the shock was optically evidenced by exciting the flow. The incident flow to the mass spectrometer was measured with pitot probes. The flow field for one flow condition is discussed in detail taking into consideration the source flow effects and shock waves. Author (ESRO)

N73-31425# Mullard, Ltd., Southampton (England).

THE DEVELOPMENT OF PYROELECTRIC DETECTORS FOR SPACE APPLICATIONS. REPORT ON PHASES 1 AND 2

A. E. Jenkinson, B. Bartlett, D. E. Charlton, and R. A. Lockett Paris ESRO Mar. 1973 108 p refs
(Contract ESTEC-834/69)
(ESRO-CR-67) Avail: NTIS HC $7.50

Pyroelectric thermal detectors for space applications in horizon sensors for attitude determination and for use as sensitive improved detectors in spaceborne experiments were investigated. Possible materials and production techniques were considered leading to the selection and detailed analysis of the most promising line of approach. It was concluded that TGS (triglycine sulfate) would lead to more sensitive detectors than other pyroelectric materials such as lithium sulfate or strontium barium niobate. The low Curie temperature of TGS (48 C), however, imposes operational restrictions. It was decided to develop a detector using deuterated TGS. This substitution raises the Curie temperature to about 60 C and improves the loss tangent. ESRO

N73-31426# National Physical Lab., Teddington (England). Div. of Computer Science.

THE EXTRACTION OF CONTINUOUS BOUNDARIES AND CONTOURS FROM A RASTER SCAN

Donald A. Bell Apr. 1973 32 p refs
(NPL-COM-66) Avail: NTIS HC $3.75

An algorithm which assembles continuous boundaries from a black-and-white picture as the scene is being scanned, without needing to store more than one line and two picture points of the raster scan is described. It uses a 2 by 2 scanning window to select which of 16 rules to apply to extend, create, or terminate a boundary. These rules correspond to the possible states of the four points in the window. An informal rationale for the rules is discussed, and example pattern is worked through, and the text of an ALGOL 60 program to demonstrate the algorithm is given. The application of the method to a hexagonal array is examined along with the problem of extracting contour lines at several different brightness levels simultaneously as a picture with a full brightness range is being scanned. Author (ESRO)

N73-31427# Naval Postgraduate School, Monterey, Calif.

INSTRUMENTATION OF A CESSNA 310H AIRCRAFT FOR ACADEMIC INVESTIGATION OF FLYING QUALITIES AND PERFORMANCE CHARACTERISTICS M. S. Thesis

George Harrison Davis, Jr. and Paul Joseph Valovich, Jr. Jun. 1973 116 p refs
(AD-764479) Avail: NTIS CSCL 01/4

The two-course study of flight evaluation techniques offered by the Aeronautics Department of the Naval Postgraduate School requires an airborne laboratory phase of instruction that introduces the student to the actual problems encountered in obtaining accurate inflight data. To satisfy this need, a civilian registered Cessna 310H aircraft, N164X, was leased by the Naval Postgraduate School in April, 1973. An airborne data acquisition system was designed and installed that allows three students to obtain individual measurements of twelve performance and stability and control parameters. The measurements are obtained using both electrical and differential pressure sensors, and are manually recorded by each student. Due to time constraints, no in-flight evaluation of the system has yet been conducted. Author (GRA)

N73-31428# Wyle Labs., Inc., Huntsville, Ala.

A RESONANCE TUBE APPARATUS FOR ABSORPTION MEASUREMENTS

F. Chien Jun. 1973 18 p refs
(Contract DAHC04-69-C-0088)
(AD-764286; AROD-8725-8-E) Avail: NTIS CSCL 20/1

A theoretical model of atmospheric absorption of sound previously has been proposed which more accurately accounts for molecular relaxation of the various constituents in air. Rate constants for these relaxation processes in binary gas mixtures and the concentration of each component are required in the calculations than room temperature, it is necessary to know these rate constants as a function of temperature. Such information can be extracted from sound absorption measurements with binary gas mixtures at various temperatures. This report presents preliminary information the design of an experimental program directed towards obtaining these rate constants by sound absorption measurements at low frequencies. The study is part of a continuous basic research program on sound absorption in air. Author (GRA)

N73-31429# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.

HYBRID CONTROL COMPONENTS, FLUIDIC: HYDROMECHANICAL INTERFACE STUDY Technical Report, Jun. 1972 - Apr. 1973

David A. Stignani Jun. 1973 66 p
(Contract F33615-72-C-2089; AF Proj. 3066)
(AD-764368; GAPD-2770-3411; AFAPL-TR-73-33) Avail: NTIS CSCL 13/7

A (pinch tube) concept was evaluated as a fluidic-to-hydromechanical interface for application to gas turbine engine control systems. The particular application selected for implementation in prototype hardware was a fuel flow valve for small gas turbine or ramjet engines. Based on initial testing of a ponch tube which utilized only fluid interactions, it was established that a mechanical advantage would be required to multiply the low-level fluidic signal (plus or minus 5 psid) to a high-level hydraulic signal (700 psia). Bench testing of a prototype pinch tube, using a 4-inch diameter force multiplying piston, demonstrated comparatively high slew rates and an insensitivity to Mil Spec vibration. However, significant non-linearities and hysteresis were evident. (Modified author abstract) GRA

N73-31430# Army Aviation Systems Test Activity, Edwards AFB, Calif.

FLIGHT EVALUATION - AEROFLEX TRUE AIRSPEED VECTOR SYSTEM Final Report, 17 Nov. 1970 - 29 Aug. 1972

Kenneth R. Ferrell, Albert L. Winn, James S. Kishi, and Robert P. Jefferis Mar. 1973 98 p refs
(AD-764240; USAASTA-71-30-2; Rept-2) Avail: NTIS CSCL 01/4

Test airspeed probes are generally pitot-static systems. These systems measure an indicated airspeed which must be corrected for position error and air density deviations from sea-level, standard-day conditions to obtain true airspeed. The pitot-static system is normally inaccurate at low airspeeds and may have a limited acquisition range for angles of attack and sideslip. In this case, directional airflow information must be obtained from an independent source. A true airspeed vector system was

developed which measures true airspeed and sideslip angle directly. The system design threshold was 0.1 knot, with omnidirectional sensing of sideslip angle. Successful laboratory and wind tunnel results of prototype systems led to the construction of a production system which was flight-tested on UH-1C and OH-58A helicopters, and an F-51D fixed wing aircraft. The Aeroflex system was tested at five locations on the helicopters. (Modified author abstract) GRA

N73-31431# Army Foreign Science and Technology Center, Charlottesville, Va.
GEOMETRIC CHARACTERISTICS OF PANORAMIC AERIAL PHOTOGRAPHIC IMAGE CONSTRUCTION
V. I. Akovetskii and Yu. N. Kornee 22 Mar. 1973 12 p refs Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow), no. 12, 1971 p 42-48
(AD-764168; FSTC-HT-23-1858-72) Avail: NTIS CSCL 14/5

Compensation formulas are derived for two types of panoramic aerial camera: continuous-scanning and rotating-prism. GRA

N73-31432# Army Weapons Command, Rock Island, Ill. General Thomas J. Rodman Lab.
TARGET ACQUISITION MODEL FOR CANNON-LAUNCHED GUIDED PROJECTILES
M. J. Amoruso and G. E. VanDamme Apr. 1973 60 p refs
(DA Proj. 1X2-63309-O-073)
(AD-763909; AMSWE-R-RR-T-6-25-73) Avail: NTIS CSCL 17/5

A target acquisition model developed in the Research Directorate, General Thomas J. Rodman Laboratory, Rock Island Arsenal, is described that takes into account atmospheric absorption and scattering at 1.06 micrometers phenomenologically. Modifications to this algorithm to adapt it to 10.6 micrometers are indicated. The target is modeled as a diffusely reflecting hemisphere. The impact of clear air scintillation effects on target acquisition is discussed. Computer programs to implement the model are included with sample outputs.
Author (GRA)

N73-31433# Army Materials and Mechanics Research Center, Watertown, Mass. Materials Sciences Div.
QUADRUPOLE MASS SPECTROMETER FOR DIRECT SAMPLING OF ATMOSPHERIC GASES AND CONDENSATION PRODUCTS
Sin-Shong Lin Mar. 1973 22 p refs
(DA Proj. 1T0-61102-B-13A)
(AD-764238; AMMRC-TR-73-9) Avail: NTIS CSCL 14/2

An apparatus for sampling atmospheric gases and condensation products has been designed and fabricated. A quadrupole mass spectrometer and modulated beam technique were used for beam detection. The design detail and the system performance are described and results are briefly presented. The sensitivity of the sampling device researches reaches parts per million, and numerous large clusters and aggregates generated from supercooling of gases during sampling processes were detected.
Author (GRA)

N73-31434# Army Edgewood Arsenal, Md.
AN ANALOG SAMPLE-AND-HOLD CIRCUIT FOR CALIBRATION MONITORING Technical Report, Mar. 1970 - Jun. 1972
Arthur T. Johnson Jul. 1973 26 p refs
(DA Proj. 1W6-62710-A-095)
(AD-764242; EA-TR-4725) Avail: NTIS CSCL 14/2

Instances may arise where it is important to monitor system calibration for long periods of time. It is frequently inconvenient to recalibrate the measuring system, especially during testing. A sample-and-hold circuit which stores necessary recalibration levels for long periods of time has been designed, built, and evaluated. Depending on the operational amplifier used, the circuit is capable of less than 7 mv/hr voltage drift over the full plus or minus 10v input voltage range. Author (GRA)

N73-31435# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
AN AURAL DETECTION MODEL
Donald C. Taylor and Arthur C. Poe May 1973 55 p refs
(DA Proj. 1X2-64306-D-646)
(AD-764226; RD-TR-73-11) Avail: NTIS CSCL 17/1

The report describes an aural detection model for detection of low flying aircraft. It incorporates ambient sound pressure levels, weather conditions (including wind effects), and attenuations of the signal along the flight path, and allows target signatures to be inputed as measured at aspect angles. The output of the model includes a probability of detection versus time together with all pertinent conditions at time of detection. Author (GRA)

N73-31436# Ohio State Univ., Columbus. Dept. of Physics.
LIQUID HELIUM LEVEL DETECTOR
James C. Garland and Dale J. VanHarlingen Jun. 1973 12 p refs
(Grant NSF GH-33385)
(PB-221313; NSF-73-51-GH-33385) Avail: NTIS HC $3.00 CSCL 14B

A liquid helium level detector is described which uses carbon composition resistors as level sensors. By using a digital pulsing technique, a quasi-continuous indication of the level is made possible without excessive heat flow into the liquid.
Author (GRA)

N73-31862* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SILICON VIDICON CAMERA FOR SLOW SCAN OPERATION
W. M. Potter *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 27-36 (For availability see N73-31858 22-34)
CSCL 14E

N73-31903* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PASSIVE MICROWAVE IMAGES OF LAKE ICE
Per Gloersen *In its* Significant Accomplishments in Sci. 1973 p 187-189 (For availability see N73-31867 22-34)
CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-31437 Minnesota Univ., Minneapolis.
A STUDY OF THE DYNAMICS OF ROTORS WITH THREE-DIMENSIONAL ROTATORY INERTIA WHEN MOUNTED ON FLEXIBLE SHAFTS WITH ELASTIC SUPPORTS Ph.D. Thesis
David dAlembert Ardayfio 1972 154 p
Avail: Univ. Microfilms Order No. 73-10682

The study of the dynamics of the constant-speed rotor is based on a discrete eight degree of freedom model with coupled linear and angular motion. The shaft and supports are regarded as linear lumped parameter elastic elements. Asymmetries in shaft-bending stiffnesses, principal moments of inertia and shaft supports are permitted. The equations of motion derived by Lagrange's equations are linear ordinary differential equations with periodic coefficients due to the asymmetries in inertia and shaft flexibility. The equations of dynamics are shown to be of the vector-matrix form. These system equations containing all the effects serve to identify the three analytical techniques required to solve the entire range of problems arising from asymmetric rotatory systems. Dissert. Abstr.

N73-31438*# Boeing Co., Huntsville, Ala.
A GUIDE FOR A TYPEWRITER Patent Application
Robert D. Dubois and George Pinson, inventors (to NASA) Filed 9 Aug. 1973 11 p Sponsored by NASA
(NASA-Case-MFS-15218-1; US-Patent-Appl-SN-387094) Avail: NTIS HC $3.00 CSCL 13I

An improved guide, for use in aligning within a typewriter a sheet of paper preparatory to an application of typed indicia to

a space is given. The guide is characterized by a bellcrank lever, pivotally supported by a swatch of flexible material adhesively secured to a typewriter adjacent the V-guides, and supporting at its distal end a space sight. The device also includes a pair of orthogonally related legs positionable into and out of the path of a type slug for framing a targeted space to be struck by a slug in response to a depression of a selected key. NASA

N73-31439# Australian Post Office Research Labs., Melbourne.
DEVELOPMENT OF A COATING PROCESS FOR LIQUID FILLED OPTICAL FIBRES
R. J. Western May 1973 7 p
(Rept-6803) Avail: NTIS HC $3.00

The feasibility of coating glass optical fibres in continuous lengths up to 1 km was demonstrated, and the method and the equipment developed for this purpose are briefly described.
Author

N73-31440*# Rocketdyne, Canoga Park, Calif.
FLEXIBLE ROTOR DYNAMICS ANALYSIS Final Report, Feb. 1971 - May 1973
F. A. Shen Sep. 1973 318 p refs
(Contract NAS3-14422)
(NASA-CR-121276; R-9252) Avail: NTIS HC $18.00 CSCL 13I

A digital computer program was developed to analyze the general nonaxisymmetric and nonsynchronous transient and steady-state rotor dynamic performance of a bending- and shear-wise flexible rotor-bearing system under various operating conditions. The effects of rotor material mechanical hysteresis, rotor torsion flexibility, transverse effects of rotor axial and torsional loading and the anisotropic, in-phase and out-of-phase bearing stiffness and damping force and moment coefficients were included in the program to broaden its capability. An optimum solution method was found and incorporated in the computer program. Computer simulation of experimental data was made and qualitative agreements observed. The mathematical formulations, computer program verification, test data simulation, and user instruction was presented and discussed. Author

N73-31441*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NONDESTRUCTIVE EVALUATION TECHNIQUE GUIDE
Alex Vary Washington 1973 110 p refs
(NASA-SP-3079) Avail: NTIS HC $4.25 CSCL 14D

A total of 70 individual nondestructive evaluation (NDE) techniques are described. Information is presented that permits ease of comparison of the merits and limitations of each technique with respect to various NDE problems. An NDE technique classification system is presented. It is based on the system that was adopted by the National Materials Advisory Board (NMAB). The classification system presented follows the NMAB system closely with the exception of additional categories that have been added to cover more advanced techniques presently in use. The rationale of the technique is explained. The format provides for a concise description of each technique, the physical principles involved, objectives of interrogation, example applications, limitations of each technique, a schematic illustration, and key reference material. Cross-index tabulations are also provided so that particular NDE problems can be referred to appropriate techniques. Author

N73-31442*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPARATUS FOR FORMING DRIVE BELTS Patent Application
Albert Topits, Jr., inventor (to NASA) Filed 31 Aug. 1973 23 p
(Contract NAS7-100)
(NASA-Case-NPO-13205-1; US-Patent-Appl-SN-393525) Avail: NTIS HC $3.25 CSCL 13H

An apparatus for manufacturing belts is reported with relatively movable rollers that are mounted in an oven. A belt blank of a thin polyester film is rotated on the rollers as heat is applied. Four rollers, each mounted on a separate roller assembly, are movable along appropriate tracks while a fifth centrally located roller is stationary. A pair of DC motors are operatively connected to a speed reduction gear assembly to provide a pair of rotating drive shafts that extend into the oven. One rotating shaft drives all of the rollers through a rotational gear assembly while the other drive shaft is capable of positioning the movable rollers through respective rotating threaded shafts. Control devices are provided for controlling the motors while measuring devices are operatively connected to the positional drive shaft to indicate the position of the rollers. NASA

N73-31443*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATERIAL SUSPENSION WITHIN AN ACOUSTICALLY EXCITED RESONANT CHAMBER Patent Application
Taylor G. Wang, Melvin M. Saffren, and Daniel D. Elleman, inventors (to NASA) Filed 31 Aug. 1973 27 p
(Contract NAS7-100)
(NASA-Case-NPO-13263-1; US-Patent-Appl-SN-393523) Avail: NTIS HC $3.50 CSCL 13H

A device for use in a spacecraft, where there are only small acceleration or gravity forces, to suspend an object at the center of a chamber while manufacturing operations are performed on the object is described. The system holds an object at the center of a chamber of rectangular cross-section, by the use of three acoustic transducers that generate sound waves. The frequencies of the sound waves are chosen so that a standing wave pattern is established. This standing ave pattern produces a pressure minimum at the center of the chamber, so that the object tends to remain there without any need for physical contact from a support. This permits manufacturing operations such as the melting of materials without contamination from contact with furnace walls. NASA

N73-31444*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVACUATED DISPLACEMENT COMPRESSION MOLDING Patent Application
Wilbur C. Heier, inventor (to NASA) Filed 13 Jul. 1973 19 p
(NASA-Case-LAR-10782-2; US-Patent-Appl-SN-379049) Avail: NTIS HC $3.00 CSCL 13I

A process of molding long thin walled tubular bodies from thermosetting plastic molding compounds is reported wherein the tubular body lengths may be several times the diameters. The process is accomplished by loading a predetermined quantity of molding compound into a female mold cavity closed at one end by a force mandrel. After closing the other end of the female mold with a balance mandrel, the loaded cavity is evacuated by applying a vacuum. The mold temperature is raised to the minimum temperature at which the resin constituent of the compound will soften or plasticize. A mold insert may be attached to the female mold to permit molding of exterior spiral threads on one end of the molded article. NASA

N73-31445*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHOCK ABSORBING MOUNT FOR ELECTRICAL COMPONENTS Patent Application
Robert F. Dillon, Jr. and Robert C. Mayne, inventors (to NASA) Filed 10 Sep. 1973 14 p
(Contract NAS7-100)
(NASA-Case-NPO-13253-1; US-Patent-Appl-SN-395687) Avail: NTIS HC $3.00 CSCL 13I

A shock absorbing mount is described for individually isolating the components of an electrical circuit board from effects of shock. The mount includes a base mounted on a circuit board coupled with a receiver through a body formed of viscoelastic material that serves to isolate the receiver from the effects of shock to which the base is subjected. NASA

N73-31446*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS AND METHOD OF MOLDING Patent Application
Wilbur C. Heier, inventor (to NASA) Filed 11 Apr. 1973 16 p
(NASA-Case-LAR-10489-2; US-Patent-Appl-SN-350300) Avail: NTIS HC $3.00 CSCL 13H

An appraratus and method for compression molding of thermosetting plastic compositions is reported wherein heat is

applied to the compressed load in a mold cavity and adjusted to hold molding temperature at the interface of the cavity surface and the compressed compound to produce a thermal front. This thermal front advances into the evacuated compound at mean right angles to the compression load and toward a thermal fence formed at the opposite surface of the compressed compound.
NASA

N73-31447# Technische Universitaet, Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
MICRODEFFECTS IN WELDING MATERIALS ON UNALLOYED ELECTRODE RODS Ph.D. Thesis [MIKROFLECKE IM SCHWEISSGUT UNLEGIERTER STABELEKTRODEN]
Ferdinand Potthoff 1972 122 p refs In GERMAN
Avail: NTIS HC $8.25

The effects of small impurities and voids in welding materials on the quality of final welds were investigated. The various parameters which influence the strength of welded joints are identified. Photomicrographs of welded joints are provided as visual evidence of welding defects. The data are presented as graphs and tables for the types of welds and the types of electrodes tested. Transl. by P.N.F.

N73-31448*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
PIONEER VENUS MECHANICAL ROOTS PUMP TEST AND EVALUATION Final Report
N. C. Thomas and W. E. Crosmer Sep. 1973 44 p
(Contract NAS2-7384)
(NASA-CR-114660; BSR-4090) Avail: NTIS HC $4.25 CSCL 13G

A mechanical pump for use with the Pioneer-Venus probe mass spectrometer inlet system was obtained, and a limited performance testing program, including ultimate/compression ratio tests and throughput tests at three different pump speeds, was performed. Considerable operating experience with the pump was obtained over approximately 200 hours of running. The test results show general agreement with pump specifications. Author

N73-31449# Lockheed Missiles and Space Co., Palo Alto, Calif.
PNEUMATIC DAMPING IN A CRYOGENIC PNEUMATIC ARMATURE
N. T. Romanenko, S. N. Prudnikov, and Iu. F. Kulikov 1972 5 p refs Transl into ENGLISH from Izv. Vyssh. Ucheb. Zaved, Mashinostr. (Moscow), no. 7, 1973 p 83-87
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Results are presented of a theoretical and experimental investigation of pneumatic drivers of overlapping units to produce drivers with a given law of variation of the motion velocity and activation time. It was shown that the magnitude of the valve setting velocity in the seat can be diminished. Data also show that the necessary activation time can be obtained for approximately determining the velocity of piston motion of the pneumatic driver. Author

N73-31450*# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.
[BIDIRECTIONAL REFLECTANCE OF ZINC OXIDE] Quarterly Progress Report
Robert Scott Aug. 1973 28 p refs
(Grant NGR-19-005-009)
(NASA-CR-135494) Avail: NTIS HC $3.50 CSCL 13H

This investigation was undertaken to determine original and useful information about the bidirection reflectance of zinc oxide. The bidirectional reflectance will be studied for the spectra between .25-2.5 microns and the hemisphere above the specimen. The following factors will be considered: (1) surface conditions; (2) specimen preparation; (3) specimen substrate, (4) polarization; (5) depolarization; (6) wavelength; and (7) angles of incident and reflection. The bidirectional reflectance will be checked by experimentally determined angular hemispherical measurements or hemispherical measurements will be used to obtain absolute bidirectional reflectance. Author

N73-31451# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.
HOT WIRE ANEMOMETER WELDING ASSEMBLY
D. Benn Feb. 1973 15 p refs
(AERE-R-7304) Avail: AEC Depository Libraries HC $3.00; HMSO 50p; PHI $2.15

A device for repairing hot wire anemometer wires which break during experiments to measure turbulent flow is described. A welding procedure is used for the repair process. Diagrams of the welding equipment are provided. An explanation of the method of using the equipment is included. Author

N73-31452# SKF Industries, Inc., King of Prussia, Pa.
DEVELOPMENT OF HIGH TEMPERATURE ROLLING BEARINGS FOR OPERATION IN LIQUID SODIUM Interim Final Report No. 1, 15 Jun. 1970 - 30 Jun. 1972
W. E. Jamison, J. J. McVeigh, A. Schwartz, R. Pilkington, and R. Nash 1972 161 p refs
(Contract AT(11-1)-3061)
(NYO-4117-9) Avail: NTIS HC $7.60

A program is underway to develop rolling bearings for operation in a liquid sodium environment in the temperature range 800 to 1200 F. This work, in support of the Liquid Metal Fast Breeder Reactor (LMFBR) development program, has identified typical applications for rolling bearings in liquid sodium, and has established preliminary materials and design requirements and manufacturing procedures for these rolling bearings. A test facility has been established which is capable of testing rolling bearings in liquid sodium at temperatures up to 1200 F, at speeds up to 1500 rpm and under thrust loads up to 1000 pounds. Materials evaluation specimens, having the configuration of two flat washers separated by three cylindrical rollers whose axes intersect the flat washer axes, have been made from Rex 49 and NM100 tool steels and from Udimet 700 nickel base superalloy. A test series with the Rex 49 specimens was run.
Author (NSA)

N73-31453# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
METAL-CERAMIC JOINTS [METALL-KERAMIKVERBINDUNGEN]
H. Schmidt-Bruecken and W. Schlapp Jan. 1972 38 p refs In GERMAN
(FTZ-A-97-TBR-2) Avail: NTIS HC $4.00

Three different metal-ceramic bonding methods are discussed. The first two methods, metallizing over burnt-in heavy metal oxides, and explosive metallizing are shown to have their limits for technical application. The third method dry soldering, is found to be the ideal bonding method. This method is described, and the advantages are shown. It is also shown that this bonding technique can be used not only on oxide ceramics, but also on nonoxide ceramic materials such as the nitrides, borides, carbides, and silicides. A variation of this method can be applied to diamond-metal bonding. ESRO

N73-31454# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUSION WELDING OF ALUMINUM TO STEEL
V. R. Ryabov 9 Jul. 1973 236 p refs Transl. into ENGLISH from the monograph "Svarka Plavleniem Alyuminiya so Stalyu" 1969 p 1-232
(AF Proj. 7351)
(AD-764322; FTD-MT-24-111-73) Avail: NTIS CSCL 13/5

Contents: Present state of the art in welding aluminum and its alloys to steel; Study of the interaction of aluminum with iron and steel during heating; Investigating the heat propagation process in an aluminum/steel joint; The formation of intermetallic phases during welding and their effect on the properties of steel/aluminum welded joints; Development of the technology for welding aluminum and its alloys to steels. GRA

N73-31455# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF ISOTHERMAL FORGING OF TITANIUM CENTRIFUGAL COMPRESSOR IMPELLER Final Technical Report, 7 Dec. 1971 - 31 May 1973
T. Watmough May 1973 98 p refs
(Contract DAAG46-72-C-0067)
(AD-764266; IITRI-B6115-16; AMMRC-CTR-73-19) Avail: NTIS CSCL 13/8

The technology of isothermal forging of titanium has been

successfully extended to the production of impeller forgings. A four-part nickel-base superalloy die set weighing approximately 2000 lb was made and used to produce ten Ti-6Al-4V alloy forgings. The ten forgings were 13 1/2 in. OD, had a plan area of 114 sq. in., weighed between 24 and 25 1/2 lb, and had 36 blades radially emanating from the hub. The blades were 0.160 in. thick at the thinnest portion and had depths ranging from 3/4 to 1/2 in. depending upon location. The thickness of the hub portion of the forging at the 13 1/2 in. OD was typically 0.210 in. Preform temperatures were typically 1750F and die temperatures 1600F. Press forging loads were usually 1000 tons, equivalent to 17 kpsi forging pressure. (Modified author abstract) GRA

N73-31456# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
HYDRAULIC PUMP-LOOP CIRCUIT EVALUATION OF NAVAL AIR DEVELOPMENT CENTER DEVELOPED SILICONE BASE NONFLAMMABLE HYDRAULIC FLUID (NADRAUL MS-5 Progress Report
Paul J. Ceban and Alfeo A. Conte, Jr. 25 Apr. 1973 39 p refs
(AD-764064; NADC-73090-30) Avail: NTIS CSCL 11/8

A candidate silicone base nonflammable hydraulic fluid designated NADRAUL MS-5 was evaluated for performance in a hydraulic pump-loop circuit test stand. A Vickers offset model pump was operated at 225F and 3000 psi system pressure in conjunction with Buna N elastomer seals. A total of 500 hours of performance was achieved before the test was arbitrarily stopped in order to determine the condition of pump components. Based on the operating conditions monitored during the test and a pretest and post-test examination of the pump, it was determined that NADRAUL MS-5 silicone base fluid possesses improved antiwear properties in comparison to other silicone fluids. No abnormal wear or deterioration of the pump was observed. In addition, no operating difficulties were experienced throughout the 500 hour test. Author (GRA)

N73-31457# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STEELS FOR LOW-TEMPERATURE SERVICE
O. A. Bannykh and Ku. K. Kovneristyi 12 Jul. 1973 18 p Transl. into ENGLISH from "Stali Slya Raboty Pri Nizkikh Temperaturakh" Moscow, Metallurgiya Publishing House, 1969 p 41-49
(AD-763947; NISC-Trans-3454) Avail: NTIS CSCL 13/4

Contents: Use of 9% nickel steel; and Heat treatment of steel sheets containing 9% Ni, used for reservoirs. GRA

N73-31458# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STATE OF THE ART OF ARGON-ARC WELDING TECHNOLOGY IN JOINING ALUMINUM AND ALUMINUM ALLOYS TO STEEL
G. A. Belchuk, V. R. Ryabov, and V. I. Yumatova 12 Jul. 1973 47 p Transl. into ENGLISH of the mono. "Sovremennoe Sostoyanie Tekhnologii Argono-Dugovoi Scarki Alyuminiya i Ego Splavov so Stalyu" Leningrad, 1967 p 11-27, 130-137, 163-173
(AD-763948; NISC-Trans-3453) Avail: NTIS CSCL 13/8

Topics included are the use of alloyed filler metal, special features of welding aluminum alloy to 18-8(1Kh18N9T) steel, corrosion resistance of welded aluminum-alloy and steel joints, some examples of industrial application of argon-arc welding technology in joining aluminum and aluminum alloy to steel, some fields of application of chromium-nickel austenitic steels, and properties of the most widely-used Fe-Cr-Ni-Mn and Fe-Cr-Mn steels. GRA

N73-31459# Naval Air Test Facility, Lakehurst, N.J.
ANALYTICAL TECHNIQUES FOR CYCLICAL EQUIPMENT EXHIBITING RELIABILITY GROWTH
Willi K. Kraut 22 Dec. 1972 50 p refs
(AD-763341; NATF-COS-3) Avail: NTIS CSCL 14/4

Presented in the report are two procedures for determining reliability growth of cyclic equipment. The first, a development stage reliability growth procedure, is used to estimate reliability growth of systems under development and requires distinctions between inherent and assignable cause failures. Application of this procedure during test phases would more rapidly increase reliability and lessen requirements for prolonged development tests. The second procedure, a continuous reliability growth model, makes use of the geometric probability distribution and relationships between cumulative number of failures and service life. This procedure enables calculation of reliability at any cycle of service life spectrums. For both reliability growth procedures, techniques to obtain confidence intervals were developed. (Modified author abstract) GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-31460 Maryland Univ., College Park.
QUANTUM DETECTION AND ESTIMATION IN OPTICAL COMMUNICATION SYSTEMS Ph.D. Thesis
Myong Chul Kim 1972 114 p
Avail: Univ. Microfilms Order No. 73-11395

Consideration is given to the detection and estimation problems in communication systems described by quantum mechanical models. The detection problems are mainly concerned with noncommutative density operators. In the formulation of the optimum detection problem with minimum probability of error criterion, the probability of correct decision is expressed as an inner product between two vectors, one of them being the a priori probability vector of hypotheses. A solution for the optimum detection operator is then found geometrically by finding a vector which has maximum projection along the a priori probability vector. Examples in binary detection problem are given for commutative and noncommutative density operator cases in single and product Hilbert space. Also considered is the optimum detection of a coherent signal with completely known phase in thermal background radiation. Dissert. Abstr.

N73-31461 Ohio State Univ., Columbus.
HOLOGRAPHIC LENS SYSTEMS Ph.D. Thesis
Harold Wayne Rose 1972 323 p
Avail: Univ. Microfilms Order No. 73-11565

The primary task is to find the first order transformation, by application of Hamilton's method. The general form of the transformation found is simplified by application of geometrical constraints, so that these elements could be conveniently compared to conventional elements. It was determined that first order stigmatism can be achieved even though the elements are the off-axis variety. Systems of such elements are illustrated for various purposes such as image projection, magnification, telescopy, and Fourier transformation. Further discussion centers on the chromatic characteristics of systems of holographic lenses. It was concluded that holographic lens systems cannot compete with conventional devices for imaging with broad band light, but that they should definitely be considered for laser illuminated applications. Dissert. Abstr.

N73-31462 Ohio State Univ., Columbus.
ABSORPTION MEASUREMENTS OF THE 10.4 MICRON REGION USING A CO2 LASER AND A SPECTROPHONE Ph.D. Thesis
Gary Lee Trusty 1972 86 p
Avail: Univ. Microfilms Order No. 73-11593

A spectrophone cell and a data acquisition system were developed and used to make low level absorption measurements of carbon dioxide and water vapor. A 1 watt per line carbon dioxide laser was used as the source. Measurements were made of the absorption of the P branch of the 10.4 micron band of CO2. Results of these measurements were used to calculate the self broadened and foreign broadened Lorentz half widths of the lines in that band as of reaction of the rotational quantum number. The gases used for foreign broadening were nitrogen, argon and helium. Absorption measurements of water vapor-nitrogen mixtures were made in the 10.4 micron region. The absorption coefficient of the continuum in this region was found to have a positive slope with increasing wavenumber. Preliminary studies were done measuring the temperature

dependence of the water vapor absorption coefficient at wavelengths corresponding to the P(20) and the P(32) lines of the CO2 laser. Dissert. Abstr.

N73-31463 Michigan Univ., Ann Arbor.
INTERFEROMETRIC MEASUREMENT OF THREE-DIMENSIONAL TEMPERATURE FIELDS Ph.D. Thesis
Donald Wesley Sweeney 1972 136 p
Avail: Univ. Microfilms Order No. 73-11270

Numerical and analytical techniques are presented which allow asymmetric temperature fields to be reconstructed from the path length measurements obtained with holographic interferometry. Numerical simulations using six different reconstruction techniques show that with a 180 deg angle of view, all of the schemes provide accurate reconstructions. Examples of simulated reconstructions are presented in which only a 45 deg angle of view available. The results reveal increased errors as of angle of view decreases. The techniques are applied to determine the temperature field in the steady state convective plume above a short heated horizontal wire in water. Phase grating illumination is used to eliminate the problems associated with coherent speckle. The techniques are also used to reconstruct the temperature field above a heated horizontal plate. The results reveal the same basic characteristics that have been observed in previous flow visualization experiments. Dissert. Abstr.

N73-31464 California Univ., San Diego.
COMPUTER HOLOGRAMS: IMPROVING THE BREED Ph.D. Thesis
William John Dallas 1973 147 p
Avail: Univ. Microfilms Order No. 73-10967

Two different computer generated hologram forms - the binary and kinoform - are examined. Improvements and special features of each form are outlined. Diffusers used in making binary holograms and kinoforms are discussed as well as tests for comparing the performance of diffusers with presently used ones. Data are also given on kinoform fabrication using an optical spatial filtering step, production of multiplex computer generated binary holograms, and quantization in computer generated holograms. A method is included for reducing quantization noise in the reconstructed iamge. Dissert. Abstr.

N73-31465 New York Univ., N.Y.
INTERACTION OF PICOSECOND LASER PULSES WITH MATTER Ph.D. Thesis
Robert R. Alfano 1972 180 p
Avail: Univ. Microfilms Order No. 73-11666

An intense picosecond laser beam is used to investigate four-photon effects and temporal behavior of optical phonons. The less well known four-photon effects such as self phase modulation and four-photon parametric generation are studied experimentally and theoretically. Mechanisms for these processes are given. Self phase modulation and small scale filament formation are observed in numerous crystals, glasses, and liquids including liquefied and solidified rate gases. The lifetime of 1086 cm-1 optical phonon in calcite is measured directly by using the picosecond laser beam to create the phonons by stimulated Raman scattering, and then observing Raman scattering off the phonons at various delay times with a weaker probe picosecond beam. The lifetime was measured in different phonon decay regimes. A theoretical analysis is given for the phonon decay process and probe-Raman light scattering process. Dissert. Abstr.

N73-31466 Duke Univ., Durham, N.C.
CORRECTION OF ABERRATIONS IN LONG WAVELENGTH HOLOGRAPHY Ph.D. Thesis
Martin Dale Fox 1972 79 p
Avail: Univ. Microfilms Order No. 73-11622

An approach to aberration correction in long wavelength holography was developed. Appropriate amplitude and phase correction factors are introduced to compensate for some of the abberations inherent in using large construction to reconstruction wavelength ratios. These aberrations currently prevent the use of long wavelength holograms in many practical geometries. Insertion of corrections can be accomplished either by direct injection in the hologram formation process ,or through a computer generated correction plate. To test the proposed correction scheme, holograms formed in a configuration known to be highly aberrated were synthesized using a computer controlled plotter. The reconstructions from the uncorrected holograms were severely degraded by aberrations. When either of the suggested correction methods were applied, however, higher resolution approaching the Rayleigh limit was obtained with a concurrent improvement in general image quality. Dissert. Abstr.

N73-31467*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP TRAP, LASER ACTIVATED IMAGE CONVERTING SYSTEM Patent Application
Joseph Maserjian, inventor (to NASA) Filed 22 Aug. 1973 19 p
(Contract NAS7-100)
(NASA-Case-NPO-13131-1; US-Patent-Appl-SN-390468) Avail: NTIS HC $3.00 CSCL 20E

A system is disclosed for receiving an optical image on the surface of a photoconducting semiconductor, storing the image in deep traps of the device, and later scanning the semiconductor with a laser beam to empty the deep traps, thereby producing a video signal. The semiconductor is illuminated with photons of energy h nu greater than the band gap delta E producing electron-hole pairs in the semiconductor which subsequently fill traps of a depth delta E sub t in energy from the band edges. When the laser beam of low energy photons excites the trapped electrons and holes out of the traps into the conduction and valence bands, a photoconductivity can be observed. NASA

N73-31468*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LASER BEAM INTENSITY CONTROL FOR THERMO-MAGNETIC RECORDING AND MAGNETO-OPTIC PLAY-BACK SYSTEMS Patent Application
George W. Lewicki and John E. Guisinger, inventors (to NASA) Filed 6 Oct. 1971 27 p
(Contract NAS7-100)
(NASA-Case-NPO-11317-2; US-Patent-Appl-SN-187143) Avail: NTIS HC $3.50 CSCL 20E

A system is presented for maintaining the intensity of a laser beam substantially constant in a thermomagnetic recording and magneto-optic playback system in which an isotropic film is heated along a continuous path by the laser beam for recording. As each successive area of the path is heated locally to the vicinity of its Curie point in the presence of a controlled magnetic field, a magneto-optic density is produced proportional to the amplitude of the controlled magnetic field. To play back the recorded signal, the intensity of the laser beam is reduced and a Faraday or Kerr effect analyzer is employed, with a photodetector, as a transducer for producing an output signal. The light intensity of the laser beam is continuously detected close to the analyzer, particularly during playback operation, and compared with a reference to maintain intensity substantially constant. NASA

N73-31469*# Aerojet-General Corp., Azusa, Calif.
LASER COMMUNICATION EXPERIMENT. VOLUME 1: DESIGN STUDY REPORT: SPACECRAFT TRANSCEIVER. PART 1: TRANSCEIVER DESIGN
Jul. 1970 492 p refs
(Contract NAS5-21072)
(NASA-CR-132803; Rept-4033-Vol-1-Pt-1) Avail: NTIS HC $26.75 CSCL 20E

The ATS-F Laser Communications Experiment (LCE) is the first significant step in the application of laser systems to space communications. The space-qualified laser communications system being developed in this experiment, and the data resulting from its successful deployment in space, will be applicable to the use of laser communications systems in a wide variety of manned as well as unmanned space missions, both near earth and in deep space. Particular future NASA missions which can benefit from this effort are the Tracking and Data Relay Satellite System and the Earth Resources Satellites. The LCE makes use of carbon dioxide lasers to establish simultaneous, two-way communication between the ATS-F synchronous satellite and a ground station. In addition, the LCE is designed to permit communication with a similar spacecraft transceiver proposed to be flown on ATS-G, nominally one year after the launch of ATS-F. This would be

the first attempt to employ lasers for satellite-to-satellite communications. Author

N73-31470*# Aerojet-General Corp., Azusa, Calif.
LASER COMMUNICATION EXPERIMENT. VOLUME 1: DESIGN STUDY REPORT: SPACECRAFT TRANSCEIVER. PART 2: APPENDICES
Jul. 1970 311 p refs
(Contract NAS5-21072)
(NASA-CR-132804; Rept-4033-Vol-1-Pt-2-App) Avail: NTIS HC $17.75 CSCL 20E

The application of a carbon dioxide laser for optical communication with ATS satellites is discussed. The following elements of the laser communication equipment are reported: (1) operational ground equipment, (2) data acquisition plan, and (3) data processing, reduction, and analysis plan. Author

N73-31471*# Aerojet-General Corp., Azusa, Calif.
LASER COMMUNICATION EXPERIMENT. VOLUME 1: DESIGN STUDY REPORT: SPACECRAFT TRANSCEIVER. PART 3: LCE DESIGN SPECIFICATIONS
Jul. 1970 277 p refs
(Contract NAS5-21072)
(NASA-CR-132805; Rept-4033-Vol-1-Pt-3) Avail: NTIS HC $16.00 CSCL 20E

The requirements for the design, fabrication, performance, and testing of a 10.6 micron optical heterodyne receiver subsystem for use in a laser communication system are presented. The receiver subsystem, as a part of the laser communication experiment operates in the ATS 6 satellite and in a transportable ground station establishing two-way laser communications between the spacecraft and the transportable ground station. The conditions under which environmental tests are conducted are reported. Author

N73-31472*# Texas Univ., Austin. Dept. of Astronomy.
LUNAR LASER RANGING DATA DEPOSITED IN THE NATIONAL SPACE SCIENCE DATA CENTER: FILTERED OBSERVATIONS FOR 1971 JULY THROUGH 1971 DECEMBER AND UNFILTERED PHOTON DETECTIONS FOR 1972 JANUARY THROUGH 1972 JUNE
J. Derral Mulholland and Peter J. Shelus Jul. 1973 8 p refs
(Grant NGR-44-012-219)
(NASA-CR-133927; RM-Astron-73-006) Avail: NTIS HC $3.00 CSCL 20E

Documentation to be used in conjunction with data deposited in the National Space Science Data Center is presented which concerns the filtered observations obtained during laser ranging operations between the McDonald Observatory and the Apollo 11, 14, and 15 reflectors, and the unfiltered photon detections. As part of the Lunar Laser Ranging Experiment, three widely separated reflector arrays were placed on the moon. Laser ranging equipment, both ground based on lunar based, is described, and coordinates of the intersection of the polar and transverse axes of the telescope are given. Filtered and unfiltered data are defined and discussed. K.M.M.

N73-31473# Sandia Labs., Albuquerque, N.Mex.
PULSED LASER-INDUCED VAPORIZATION OF GRAPHITE AND CARBIDES
R. T. Meyer 1973 2 p refs Sponsored by AEC
(SLA-73-5233; Conf-730601-1) Avail: NTIS HC $3.00

Results of studies on the vapor compositions of graphite and metal carbides are presented. Data are given on the relative abundances of the vapor species from the following materials, heated both by a normal-mode laser and by a Q-switched laser: graphite, TiC1.2, VC, Cr3C2, ZrC, NbC, Mo2C, HfC, TaC, WC, and UC2.2. NSA

N73-31474# Los Alamos Scientific Lab., N.Mex.
ELECTRON TRANSPORT IN GAS DISCHARGE LASERS
Dale B. Henderson Apr. 1973 10 p refs
(Contract W-7405-eng-36)
(LA-5154-MS; UC-34) Avail: NTIS HC $3.00

A set of computer codes are described for treating the transport of high energy (primary) electrons in gas discharge lasers. The requirements for this type electron transport are discussed, and several examples of the computations are included as verification and as applications of the codes to laser design. Author

N73-31475# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF THE OPERATION AND APPLICATIONS OF A HYDROCYANIC ACID GAS LASER Ph.D. Thesis - Paris Univ.
J. P. Lesieur Nov. 1972 103 p refs In FRENCH
(EUR-CEA-FC-670) Avail: AEC Depository Libraries HC $7.25

The operation of an HCN laser was studied in view of its utilization for interferometric measurements in a Tokamak machine. The HCN laser provides a coherent 337 micron beam useful for diagnostics. The laser cavity is described. The beam is extracted by a partially reflecting mirror inside the cavity. This mirror totally polarizes the laser beam. The laser power is optimized by controlling the cavity discharge parameters. About 30 mW of laser power is extracted. A fall in power of only 20% is observed after 3 hours operation, the discharge tube remaining uncontaminated. The modes of oscillation of the cavity were studied. Author (NSA)

N73-31476# California Univ., Livermore. Lawrence Radiation Lab.
REVIEW OF CALORIMETRIC MEASUREMENTS OF LASER ENERGY AND POWER
S. R. Gunn 13 Jul. 1972 34 p refs
(Contract W-7405-eng-48)
(UCID-16214) Avail: NTIS HC $3.75

The use of calorimeters for measurement of laser output energies and powers is reviewed. Pertinent principles of calorimetric measurements are briefly discussed. Instruments are categorized as disc, cone, hollow-sphere, bolometer, volume-absorption, and partial-absorption types. Author

N73-31477# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
OPTICAL TELECOMMUNICATION WITH LASERS [OPTISCHE NACHRICHTENUEBERTRAGUNG MIT LASER]
K. Juergensen Jan. 1972 25 p refs In GERMAN Lecture held at the Elektrotech. Ver., Darmstadt, West Ger., 19 Jan. 1971
(FTZ-A-465-TBR-8) Avail: NTIS HC $3.25

An introduction to optical communication with lasers is presented. The requirements of future telecommunication networks are described, and a survey is given of the high frequency part of the electromagnetic spectrum, which may be used to meet these requirements. The principles and properties of laser transmitters are discussed. Possibilities for transmission of optical signals, and experiments in this field, are described. ESRO

N73-31478# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
DIGITAL TRANSMISSION TESTS USING LASER BEAM THROUGH THE ATMOSPHERE TO DETERMINE THE OCCURRING ERROR FREQUENCY [DIGITALE UEBERTRAGUNGSVERSUCHE MITTELS LASERSTRAHL DURCH DIE ATMOSPHAERE ZUR FESTSTELLUNG DER AUFTRETENDEN REHLERHAEUFIGKEIT]
G. Herchenroeder Feb. 1973 28 p refs In GERMAN
(FTZ-44-TBR-34) Avail: NTIS HC $3.50

Digital data transmission tests were carried out on an argon laser beam propagating through a free atmosphere. The error frequency was determined with a PCM simulator device for several weather conditions. The transmission path was 3 km long, and led over built-up areas. The laser output was 1 W and was operated on its green line (514 nm). Apart from the results of measurements, special transmitter and receiver problems are discussed. It is shown that this form of digital data transmission is suitable only for specific applications. ESRO

N73-31479# Zeiss (Carl), Oberkochen (West Germany).
HOLOGRAPHIC INTERFEROMETRY (REAL-TIME) [HOLOGRAPHISCHE REAL-TIME INTERFEROMETRIE]
Adolf Friedrich Fercher, Manfred Kriese, Paul Kunstmann, and Heinz Sprongl Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1973 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-73-01) Avail: NTIS HC $4.75; ZLDI, Munich 11 DM

Based on existing techniques of holographic wavefront storage, new holographic-interferometric methods were developed for testing specularly and diffusely reflecting surfaces of optical components, as well as measuring the deformation of precision mechanical construction. Theoretical studies were made, investigating the conditions for optimum visibility of interference phenomena, the relationship between interference structures and surface forms, and methods for computing and producing synthetic holograms and testing their properties. Experiments for the setup and testing of real-time interferometers with silver halide, photoresisis, photochromic storages as well as synthetic holograms were carried out. These instruments were used for deformation measurements on lightweight mirrors and for surface testing of astronomical mirror surfaces. Author (ESRO)

N73-31480# TRW Systems Group, Redondo Beach, Calif.
AERODYNAMICS REACTIVE FLOW STUDIES OF THE H2/F2 LASER Technical Report, 16 Oct. 1971 - 15 Feb. 1973
A. B. Witte, J. E. Broadwell, W. L. Shackleford, J. E. Trost, and T. A. Jacobs Kirkland AFB, N. Mex. AFWL Jun. 1973 147 p refs
(Contract F29601-72-C-0021; AF Proj. 1256)
(AD-763828; AFWL-TR-72-247) Avail: NTIS CSCL 20/5

The research investigated experimentally and theoretically the mixing process and its influence on performance of a continuous H2-F2 laser. In the experimental investigation, detailed flow field and chemical species measurements were made in the reaction zone of two parallel flow injector configurations. A hydrogen spray bar injector configuration, similar to many of today's operating chemical lasers, was also tested, but to a lesser extent. For the parallel configuration, one important experimental result was the identification of laminar, transitional, and turbulent regions for the mixing reaction zone. In the theoretical investigation, a simplified theory of a mixing limited production of vibrationally excited HF was constructed. A closed form expression was developed which shows the effects of pertinent flow parameters on laser performance and on HF concentrations for nonlasting cases. Author (GRA)

N73-31481# Edgerton, Germeshausen and Grier, Inc., Salem, Mass.
OPTICAL PUMPS FOR LASERS Triannual Report No. 2, 24 Aug. - 23 Dec. 1972
P. Bruce Newell May 1973 51 p refs
(Contract DAAB07-72-C-0165; DA Proj. 1S6-62703-A-186)
(AD-763932; ECOM-016572-2) Avail: NTIS CSCL 20/5

The report describes the investigation and improvement of those lamp designs and operating parameters which affect laser stability and beam divergence; specifically, an improvement in the flashtube arc column spatial uniformity. A fluorescence output meter has been completed and used to measure the relative output of flashlamps ranging in bore from 1 mm to 4 mm. The text discusses noise suppression techniques useful in improving signal response of the device. The value of the cascade circuit for preionizing the lamp is demonstrated by the fluorescence meter. Photographs show that the arc diameter is increased in size with preionization only in the smaller diameter lamps operating at lower energies. (Modified author abstract) GRA

N73-31482# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
DEVELOPMENT AND APPLICATION OF ANALYTICAL MODELS FOR CHEMICAL LASERS, PART 2 Final Report
Alan W. Ratliff and Jurgen Thoenes May 1973 98 p refs
(Contract DAAH01-72-C-0493; DA Proj. 1T0-61101-A-91A)
(AD-763906; LMSC/HREC-D306475-2; RK-73-11-Pt-2) Avail: NTIS CSCL 20/5

The document is Volume II of a two-part final report. It deals with the effort involved in generating a Method-of-Characteristics Laser And Mixing Program (MOC-LAMP) to accommodate chemical laser flows and reactants in the presence of both axial and lateral pressure gradients. Portions of Volumes I and II are repetitive to provide completeness and consistency. GRA

N73-31483# Army Missile Command, Redstone Arsenal, Ala. Development and Engineering Lab.
ARC-DRIVEN N2CS2 MIXING GAS-DYNAMIC LASER
T. G. Roberts and R. L. Morgan 30 Apr. 1973 22 p refs
(DA Proj. 1T5-62609-A-308)
(AD-763898; RR-TR-73-3) Avail: NTIS CSCL 20/5

The arc-driven laser facility was made available for a brief period while the high energy pulsed laser was down, and an attempt was made to operate the facility as an O2 - CS2 chemical laser where the hot N2 from the arc was to disassociate the O2 in the plenum and He - CS2 was to be mixed with these gases in the supersonic mixing mode. However, at no time was lasing obtained when the laser was operated in this mode; but, when O2 was omitted from the plenum due to a failure to operate the O2 Marotta valve, lasing was obtained when He - CS2 was mixed with only nitrogen in the supersonic mixing mode. The results which were obtained during this brief period of experimentation are presented in this report. Author (GRA)

N73-31484# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
DEVELOPMENT AND APPLICATION OF ANALYTICAL MODELS FOR CHEMICAL LASERS, PART 1 Final Report
Jurgen Thoenes and Alan W. Ratliff May 1973 114 p refs
(Contract DAAH01-72-C-0493; DA Proj. 1T0-61101-A-91A)
(AD-763905; LMSC/HREC-D306475-1; RK-73-11-Pt-1) Avail: NTIS CSCL 20/5

A new laser and mixing analysis is described which considers the coupling between gasdynamic properties, cavity characteristics, and resulting laser radiation for diffusion-type chemical laser oscillator cavities. The formulation assumes parallel mixing and constant lateral pressure with lasing due to single or multiple transitions between certain vibrational/rotational molecular energy levels. Excitation of the active medium traversing a Fabry-Perot optical cavity is caused by highly exothermic reactions between gradually mixing reactants discharged from a grid nozzle. Uniform, premixed, inviscid laser cavity flows can be investigated as a special case of the more general analysis. Typical results are given for both uniform premixed and gradually mixing two-dimensional cavity flows. Volume 1 of this two-part final report documents the work accomplished on the development of the gain and power calculations, radiation model and its implementation into the constant lateral pressure Laser and Mixing Program (LAMP). (Modified author abstract) GRA

N73-31485# Ohio State Univ., Columbus.
MEASURED WATER VAPOR ABSORPTION COEFFICIENTS FOR TWO HIGHLY ABSORBED CO LASER LINES Quarterly Report, Apr. - Jun. 1973
Ronald K. Long, Frank S. Mills, and G. L. Trusty Jun. 1973 23 p refs
(Contract F30602-72-C-0016; ARPA Order 1279)
(AD-764376; ESL-3271-6; RADC-TR-73-225; QR-6) Avail: NTIS CSCL 20/5

Previous reports have presented measurements of water vapor absorption coefficients for those CO laser lines which are least attenuated by the atmosphere. This report gives measurements for two CO laser lines (1837.436/cm and 1872.236/cm), which are highly attenuated by water vapor. (Modified author abstract) GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-31486 Case Western Reserve Univ., Cleveland, Ohio.
MICROSTRUCTURE AND MECHANICAL BEHAVIOR IN TEMPERED HIGH STRENGTH STEELS Ph.D. Thesis
Chi Lang Choi 1972 203 p
Avail: Univ. Microfilms Order No. 73-6279

The plane strain fracture toughness was determined for 4340, 300M and 9-4-45 steels heat treated at various temperatures.

Emphasis was placed on a characterization of the microstructure and fractographic features of the silicon steel using transmission and scanning electron microscopy. Critical analysis of carbide phases was accomplished by electron diffraction and precision dark field techniques. The occurrence of epsilon carbide was identified as a transition phase in both tempered martensite and lower bainite. Precipitation of cementite started around 750 F and 650 F in martensitic and bainitic structures of 300M respectively. Based on various structural parameter measurements, an empirical analysis provided a quantitative interpretation on the strengthening mechanisms operative in tempered 300M steel. A comparison of fracture toughness of the three steels revealed that silicon plays a detrimental role as an embrittling element at high tempering temperatures. Dissert. Abstr.

N73-31487 State Univ. of New York, Stony Brook.
A STUDY OF THE MICRODYNAMICS OF INITIAL PLASTIC FLOW IN TUNGSTEN POLYCRYSTALS Ph.D. Thesis
Kedar Nath Tandon 1972 83 p
Avail: Univ. Microfilms Order No. 73-12080

Investigation of the microdynamics of initial flow in high purity tungsten polycrystals was carried out at room temperature with a view towards correlating the initial microflow behavior with the observed dislocation structure. Experiments were designed to obtain all pertinent micro-mechanical data such as micro-stress-strain and the simultaneous time derivatives of stress and strain by employing multichannel recording techniques. Etch-pit micro-structure was studied at progressively higher stress levels, and measurements were analyzed for values of the dislocation velocity which were typically approximately 0.00001 cm/sec for the initial dislocation sources activated. It was found that after activation dislocations did not move immediately to the grain boundary but rather moved a characteristic distance of approximately 0.001 cm which was only weakly dependent on applied stress for all strains < 0.0001.
Dissert. Abstr.

N73-31488 Illinois Inst. of Tech., Chicago.
THE EFFECT OF THERMAL CYCLING ON THE STRUCTURE OF THE Co-Co3Cb EUTECTIC Ph.D. Thesis
Howard Lee Arnson 1972 148 p
Avail: Univ. Microfilms Order No. 73-12196

Unidirectionally solidified Co-Co3Cb eutectic samples with and without a minor addition of nickel were subjected to long time annealing and thermal cycling treatments. The eutectic showed metallographic and crystallographic stability after vacuum annealing for periods up to 1000 hours at 1000 C. Structural stability was also observed during thermal cycling experiments conducted completely above the temperature of the cobalt FCC reversible reaction HCP phase transformation. However, when the thermal cycle included the cobalt transformation temperature, samples containing 0.2 weight per cent nickel showed microstructural breakdown, whereas samples with 0.01 weight per cent nickel did not. In addition, the latter samples quickly developed and retained the FCC form of cobalt during cycling.
Dissert. Abstr.

N73-31489 State Univ. of New York, Stony Brook.
POINT DEFECT MOTION IN AN ALPHA BRASS AND IN Cu3Au AFTER ELECTRON IRRADIATION Ph.D. Thesis
Jay Gilbert 1972 151 p
Avail: Univ. Microfilms Order No. 73-10896

The defect annealing spectra of two alloys displaying order-disorder reactions are described. CU3Au, both ordered and disordered, and 30 at.% zinc alpha brass were isochronally annealed after 1.0 Mev and 1.5 Mev electron irradiation below 20 K. The change in their electrical resistivity was monitored using a four point potentiometric technique. Enhanced ordering due to the migration of excess defects introduced by the irradiation is observed in all cases. In Cu3Au, single vacancy motion is believed responsible. In alpha-CuZn, enhanced ordering is assigned to both interstitialcy and single vacancy motion. Dissert. Abstr.

N73-31490# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON METALLURGY
26 Jul. 1973 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 3, 1973 11 p (JPRS-59623) Avail: NTIS HC $3.00

Metallurgical research is reported on: (1) thermal conductivity and electrical properties of titanium alloyed with vanadium, and (2) high temperature creep of metals with a face centered cubic lattice. For individual titles, see N73-31491 through N73-31492.

N73-31491 Joint Publications Research Service, Arlington, Va.
THERMAL CONDUCTIVITY AND ELECTRICAL PROPERTIES OF TITANIUM ALLOYED WITH VANADIUM AT 100-350 K
V. G. Karnetskiy, S. N. Lvov, and V. A. Kashchuk *In its* Transl. on Met. (JPRS-59623) 26 Jul. 1973 p 1-6 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 3, 1973 p 80-84 (For availability see N73-31490 22-17)

The effect of alloying titanium with vanadium on the electrical resistance, thermal conductivity, and thermal emf of titanium in the 100 to 350 K region was determined. Curves are given which illustrate the electrical and thermal properties obtained as functions of temperature and vanadium content. The significance of the findings is discussed. D.L.G.

N73-31492 Joint Publications Research Service, Arlington, Va.
HIGH TEMPERATURE CREEP OF METALS WITH A FACE CENTERED CUBIC LATTICE
P. N. Okrainets and V. K. Pishchak *In its* Transl. on Met. (JPRS-59623) 26 Jul. 1973 p 7-16 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 3, 1973 p 151-156 (For availability see N73-31490 22-17)

The results are presented of tests to determine the relationship of stacking fault energies with high temperature creep of metal with a face-centered cubic lattice. The test results indicate: (1) The temperature of establishment of high temperature creep and deformation in metals with a fcc lattice is determined by the stacking fault energies. (2) In strict corresponding test conditions of metals with a fcc lattice, when the mechanism of creep is the same, the mechanical properties and structural states are also the same, independent of the stacking fault energy. (3) The previously accepted opinion that the high temperature mechanism of creep of different metals sets in at the same value of homological temperature, is invalid for metals with a fcc lattice. (4) The effect of stacking fault energy of high temperature creep of metals is determined by the interaction of split dislocations with vacancies. D.L.G.

N73-31493*# Metcut Research Associates, Inc., Cincinnati, Ohio. Thermophysical Properties Research Center.
CHARACTERIZATION OF THE MECHANICAL AND PHYSICAL PROPERTIES OF TD-NiCr (Ni-20Cr-2ThO2) ALLOY SHEET
L. J. Fritz, W. P. Koster, and R. E. Taylor [1973] 244 p refs (Contract NAS3-15558)
(NASA-CR-121221) Avail: NTIS HC $14.25 CSCL 11F

Sheets of TD-NiCr processed using techniques developed to produce uniform material were tested to supply mechanical and physical property data. Two heats each of 0.025 and 0.051 cm thick sheet were tested. Mechanical properties evaluated included tensile, modulus of elasticity, Poisson's Ratio, compression, creep-rupture, creep strength, bearing strength, shear strength, sharp notch and fatigue strength. Test temperatures covered the range from ambient to 1589K. Physical properties were also studied as a function of temperature. The physical properties measured were thermal conductivity, linear thermal expansion, specific heat, total hemispherical emittance, thermal diffusivity, and electrical conductivity. Author

N73-31494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TENSILE AND FATIGUE DATA FOR IRRADIATED AND UNIRRADIATED AISI 310 STAINLESS STEEL AND TITANIUM - 5 PERCENT ALUMINUM - 2.5 PERCENT TIN: APPLICATION OF THE METHOD OF UNIVERSAL SLOPES
Claude E. DeBogdan Washington Sep. 1973 19 p refs
(NASA-TM-X-2883; E-7532) Avail: NTIS HC $2.75 CSCL 11F

Irradiated and unirradiated tensile and fatigue specimens of AISI 310 stainless steel and Ti-5Al-2.5Sn were tested in the range of 100 to 10,000 cycles to failure to determine the applicability of the method of universal slopes to irradiated

materials. Tensile data for both materials showed a decrease in ductility and increase in ultimate tensile strength due to irradiation. Irradiation caused a maximum change in fatigue life of only 15 to 20 percent for both materials. The method of universal slopes predicted all the fatigue data for the 310 SS (irradiated as well as unirradiated) within a life factor of 2. For the titanium alloy, 95 percent of the data was predicted within a life factor of 3.
Author

N73-31495# National Materials Advisory Board, Washington, D.C. Div. of Engineering.
TRENDS IN USAGE OF TUNGSTEN
Jul. 1973 107 p refs
(Contract GS-00-DS-(P)-94008)
(NMAB-309) Avail: NTIS HC $7.50

The demand for tungsten in the U. S. economy is discussed in relation to domestic and world production. Present uses of tungsten are considered as well as possible new requirements in the future. The U. S. demand for tungsten is estimated for the next 15 years in five-year intervals. Since tungsten is a strategic material and domestic production currently supplies between one half and two thirds of U. S. requirements, it is concluded that a government stockpile is needed today. By 1987, domestic reserves are expected to furnish only one quarter of the U. S. requirement. General recommendations are made concerning the future development of tungsten statistics necessary for estimating tungsten requirements more accurately. Government stockpile specifications are reviewed.
Author

N73-31496*# TRW, Inc., Cleveland, Ohio. Materials Technology Labs.
GENERATION OF LONG TIME CREEP DATA ON REFRACTORY ALLOYS AT ELEVATED TEMPERATURES Final Report
K. D. Sheffler and R. R. Ebert Sep. 1973 122 p refs
(Contract NAS3-15554)
(NASA-CR-134481; TRW-ER-7648) Avail: NTIS HC $8.25 CSCL 11F

Four separate studies of various aspects of the vacuum creep behavior of two tantalum alloys (T-111 and ASTAR 811C) and of pure CVD tungsten are reported. The first part of the program involved a study of the influence of high temperature pre-exposure to vacuum or to liquid lithium on the subsequent creep behavior T-111 alloy. Results of this study revealed significant effects of pre-exposure on the 1% creep life of T-111, with life reductions of about 3 orders of magnitude being observed in extreme cases. The second part of this study involved an investigation of the creep behavior of T-111 under conditions of continuously increasing stress and decreasing temperature which simulated the conditions anticipated in radioisotope capsule service. Results of this study showed that such test conditions produced a creep curve having a very unusual shape, and led to the identification of a new creep design parameter for this type of service. The third area of investigation was a study of the influence of heat treatment on the microstructure and creep behavior of ASTAR 811C. The fourth part of the program was directed toward a preliminary characterization of the 1% creep life of CVD tungsten as obtained from two different sources.
Author

N73-31497*# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
CONDUCTION IN FULLY IONIZED LIQUID METALS
D. J. Stevenson and N. W. Ashcroft (Kernforschungsanlage) Aug. 1973 33 p refs
(Grant NGR-33-010-188; NSF GH-36457)
(NASA-CR-135648) Avail: NTIS HC $3.75 CSCL 11F

Electron transport is considered in high density fully ionized liquid metals. Ionic structure is described in terms of hard-sphere correlation functions and the scattering is determined from self-consistently screened point ions. Applications to the physical properties of the deep interior of Jupiter are briefly considered.
Author

N73-31498*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
MECHANICAL PROPERTY DETERMINATION OF HIGH CONDUCTIVITY METALS AND ALLOYS Final Report
D. L. Harrod, E. VanDergrift, and L. France Feb. 1973 158 p refs
(Contract NAS7-725)
(NASA-CR-133890; WANL-M-FR-72-005) Avail: NTIS HC $10.00 CSCL 11F

Pertinent mechanical properties of three high conductivity metals and alloys; namely, vacuum hot pressed grade S-200E beryllium, OFHC copper and beryllium-copper alloy no. 10 were determined. These materials were selected based on their possible use in rocket thrust chamber and nozzle hardware. They were procured in a form and condition similar to that which might be ordered for actual hardware fabrication. The mechanical properties measured include (1) tension and compression stress strain curves at constant strain rate (2) tensile and compressive creep, (3) tensile and compressive stress-relaxation behavior and (4) elastic properties. Tests were conducted over the temperature range of from 75 F to 1600 F. The resulting data is presented in both graphical and tabular form.
Author

N73-31499# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CARBON MONOXIDE ADSORPTION KINETICS ON MOLYBDENUM (100)
J. Lecante, R. Riwan, and C. Guillot 7 Oct. 1972 32 p refs Presented at the 2d Symp. on Surface Phys.: The Solid Vacuum Interface, Enschede, Netherlands, 22 Jun. 1972
(CEA-Conf-2194; Conf-720679-2) Avail: AEC Depository Libraries $3.75

In an ultrahigh-vacuum system (10 to the -10th power torr) LEED, Auger spectroscopy, flash desorption, and work-function measurements were used to follow the adsorption kinetics of carbon monoxide on the (100) face of a molybdenum single crystal. At room temperature, CO adsorbs into three beta stages, beta sub 1, beta sub 2, beta sub 3, which are associated with different work-function changes: the beta sub 3 phase is found to correspond to a work-function decrease, whereas phases beta sub 1 and beta sub 2 correspond to an increase. The total change of surface potential is about 0.50 eV at saturation. An ordered C (2 x 2) structure is found for the beta sub 2 + beta sub 3 phases, which is associated at their maximum coverage (about half a monolayer) with a work-function change of +0.070 eV with respect to the clean surface. A P (1 x 1) structure is observed on completion of the monolayer.
Author (NSA)

N73-31500# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
URANIUM-TITANIUM ALLOYS: ANNOTATED BIBLIOGRAPHY
Ross J. Jackson 6 Apr. 1973 22 p refs
(Contract AT(29-1)-1106)
(RFP-2005) Avail: NTIS HC $3.00

The bibliography is complete as of January 1, 1973. The accompanying resumes do not necessarily represent an entire summary of the referenced work because emphasis was placed only on that portion dealing with binary alloys of uranium containing titanium. The references are categorized according to subject. Within a given subject, the references are listed chronologically. Progress reports and newsletters are also included in the bibliography; however, these references are listed separately, and are categorized according to source and not subject. In all cases, each reference is listed only once. A subject index is provided for overlapping subject matter. An index of organizational symbols and an author index are also provided.
Author (NSA)

N73-31501# Toulouse Univ. (France).
SEARCH FOR A UNIVERSAL DIAGRAM REPRESENTING THE CHANGES IN THE VISCOSITY OF LIQUID METALS AS A FUNCTION OF TEMPERATURE
C. Thirriot, D. Amoros, and L. Lacas 1972 6 p refs In FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6-8 Jun. 1972
(FRNC-Conf-45; Conf-720648-22) Avail: AEC Depository Libraries

A general expression for the variation of the viscosity coefficients with temperature, which utilizes nondimensional variables, was sought. Twenth-five monatomic liquid metals were considered; their viscosities were obtained by calculation or measurement.
NSA

N73-31502# National Engineering Lab., East Kilbride (Scotland).
EFFECT OF SURFACE CONDITIONS ON THE TENSILE BEHAVIOUR OF BERYLLIUM UNDER HYDROSTATIC PRESSURE
H. L. D. Pugh and E. F. Chandler Feb. 1973 22 p refs
(NEL-537) Avail: AEC Depository Libraries HC $3.25

An examination was made of the effects of different surface finishes, and of sheating the specimens by dipping in a mixture of latex rubber solution and ethyl methyl ketone, on the tensile properties of cast and extruded beryllium and hot-pressed powder beryllium when tested under a hydrostatic pressure of 7.72 kbar. It is shown that the major factor controlling ductility is not surface finish but surface sheathing. Author (NSA)

N73-31503# Bendix Corp., Kansas City, Mo.
HEAT TREATMENT OF 6Al-4V TITANIUM FORGINGS TO OBTAIN HIGH YIELD STRENGTH Technological Spinoff Report
J. H. Kuehnle Mar. 1973 21 p refs
(Contract AT(29-1)-613)
(BDX-613-872) Avail: NTIS HC $4.00

Parts machined from titanium alloy 6Al-4V were heat treated to meet a 160,000 psi (1100 MN/cum) minimum yield strength requirement. This high yield strength was obtained by using a high solution heat treatment temperature of approximately 1780 F, a short solution heat treatment time of 1 hour, and a cold (36 to 40 F) agitated water quench produced by a submerged jet fixture. A high aging temperature of 1100 F for 6 hours was used to partially relieve quenching stress. Forty-five cylinders were treated. Eighteen cylinders had one open end and 27 were shorter and open on both ends. Extensive hardness testing of these parts showed good process uniformity (RC 41.8 + or - 2.1). One part of each type was tested. Both parts had acceptable yield strength. Author (NSA)

N73-31504# Bhabha Atomic Research Centre, Bombay (India).
THERMODYNAMIC STUDY OF LIQUID COPPER-MAGNESIUM ALLOYS BY VAPOUR PRESSURE MEASUREMENTS
S. P. Garg, Y. J. Bhatt, and C. V. Sundaram 1972 32 p refs
(BARC-613) Avail: AEC Depository Libraries

Thermodynamic properties of liquid copper-magnesium alloys were determined by magnesium vapor pressure measurements over pure liquid magnesium and liquid copper-magnesium alloys in the composition range of 11 - 90 mole pot. magnesium between 845-1345 k, employing the transpiration techniques. Based on the quadratic formalism suggested by Turkdogen and Darden for binary systems, analytical expressions were derived representing integral and partial molar thermodynamic properties as functions of composition in the two terminal regions of N sub Mg = 0 - 0.33 and 0.6 - 1.0. From the measured activity standard free energies of formation of Cu2 Mg(s) and CuMg2(s) relative to pure solid components were calculated and expressed as functions of temperature. Author

N73-31505# Israel Atomic Energy Commission, Tel Aviv.
ANODIC OXIDATION OF TITANIUM AND ITS ALLOYS
A. Aladjem Oct. 1972 55 p refs
(LS-254) Avail: AEC Depository Libraries HC $4.25

The procedures used in the anodic oxidation of titanium and its alloys, the nature and properties of the oxide films, their uses, and trends in research and development are reviewed. (279 references). Author (NSA)

N73-31506# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
RELIABILITY OF STEELS IN USE
C. Segot Feb. 1973 46 p refs In FRENCH
(CEA-Bib-204) Avail: AEC Depository Libraries HC $4.50

The risks of embrittlement and cracking of steels in use are discussed under the following sections: (1) criteria for developing parts, envelopes, and equipment; (2) characteristics of the forming of steels; (3) embrittlement; and (4) cracking. Author (NSA)

N73-31507# Atomic Energy Establishment, Cairo (Egypt). Dept. of Metallurgy.
EFFECT OF TEMPERATURE AND EXTENSION RATE ON THE TENSILE PROPERTIES OF SAP
A. M. Shafie, I. A. El-Shanshoury, and F. H. Hammad 1972 18 p refs
(AREAEE-159) Avail: AEC Depository Libraries HC $3.00

The tensile properties of ISML-SAP containing 4 and 7% Al2O3 were investigated at extension rates varying from 0.0001 to 0.081 sec in the temperature range, 25 to 670 C. The specimens were found to retain their strength at temperature 10 C higher than the melting point of Al for both SAP alloys. This behavior was attributed to the presence of honeycomb structure of Al2O3 embedded in the Al matrix as suggested by Sherby and Coworkers. The ductility of SAP alloys generally decreased as the extension rate decreased. SAP-4% Al2O3 exhibited high ductility in the temperature interval 300 to 500 C and severe embrittlement at temperatures near the melting point. Al SAP-7% Al2O3 showed embrittlement at the temperature intervals 150 to 550 C and maximum ductility of temperatures around the melting point of Al. The dependence of the magnitude of ductility drop on temperature and extension rate indicated that the process responsible for ductility drop is diffusion controlled. Explanations in terms of pore formation and impurities were given. Author (NSA)

N73-31508# Defence Research Information Centre, Orpington (England).
THE EFFECT OF HEIGHTENED PLASTICITY IN COPPER
I. I. Novikov Jan. 1973 5 p refs Transl. into ENGLISH from RUSSIAN
(DRIC-Trans-3009) Avail: NTIS

Pure copper within a certain temperature range has a zone of reduced plasticity. Experiments were carried out with oxygen-free copper on circular test pieces annealed in a vacuum of 0.01 mm of mercury for one hour. It was shown that hydrogen reduced the pure copper plasticity and prestressing in a vacuum at stresses below the yield point. This could be used to eliminate plasticity failure in copper in the temperature range from 200 to 600 C. ESRO

N73-31509# Vacuumschmelze G.m.b.H., Hanau (West Germany). Entwicklungsabteilung.
SUPERCONDUCTING MATERIALS FOR ac-MAGNETS WITH RISETIME OF MAGNETIC FIELD IN THE RANGE OF SECONDS [WERKSTOFFE FUER SUPRALEITENDE WECHSELFELDMAGNETE MIT UM-MAGNETISIERUNGSZEITEN DER GROESSENORDNUNG SEKUNDE]
Hans Hillmann Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1973 83 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-73-03) Avail: NTIS HC $6.25; ZLDI, Munich 17 DM

Based on extensive work on superconductors in dc magnets, superconductors for use in pulsed magnets with one second risetime of the magnetic field were investigated. Composite materials of NiTi-based alloys on copper, copper nickel, and mixed substrates with up to 1200 filament numbers and down to 10 micron-filament diameters were developed. Electrical and mechanical properties of materials and composites were studied. Current densities of 250000 A/sq cm were reached in superconductors. ESRO

N73-31510# National Aerospace Lab., Amsterdam (Netherlands).
SOME CONSIDERATIONS FOR THE APPLICATION OF TITANIUM ALLOYS IN COMMERCIAL AIRCRAFT
R. J. H. Wanhill Mar. 1972 191 p refs Sponsored by the Neth. Agency for Aerospace Programs
(NLR-TR-72034-U) Avail: NTIS HC $11.75

The suitability of titanium alloys for application in conventional commercial aircraft was considered, as well as some aspects of fail-safe and safe-life design of aircraft components to be made from these alloys, by investigating material properties such as static strength, creep strength, low and high cycle fatigue strength, fracture toughness, hot salt and aqueous stress corrosion resistance, and fracture crack propagation. Data were compiled for high-cycle fatigue strength under axial loading, fracture toughness, and stress corrosion resistance in 3.5% aqueous NaCl.

Some problems in designing for titanium alloys in commercial aircraft are summarized. ESRO

N73-31511# National Aerospace Lab., Amsterdam (Netherlands).
FATIGUE CRACK PROPAGATION DATA FOR TITANIUM SHEET ALLOYS, Ti-5Al-2.5Sn Interim Report
R. J. H. Wanhill, A. M. Otter, W. J. VanderVet, and F. A. Jacobs Jul. 1972 101 p refs Sponsored by the Neth. Agency for Aerospace Programmes (NIVR)
(NLR-TR-72093-U; IR-3) Avail: NTIS HC $7.25

Environmental fatigue crack propagation in Ti-5Al-2.5Sn sheet was investigated. The environments were dry argon, normal air, distilled water, and 3.5% aqueous NaCl. The experimental procedure is presented and experimental results on the crack propagation in longitudinal and transverse specimens are discussed and compared to those with data from another source. ESRO

N73-31512# Illinois Univ., Urbana.
PHASE INSTABILITY DURING LOW-CYCLE FATIGUE Final Report, 1 Jul. 1969 - 30 Jun. 1972
Carl Altsletter, Daniel Hennessy, and Dilip Shah 1972 5 p refs
(Grant DA-ARO(D)-31-124-G1149; DA Proj. 200-61102-B-32D)
(AD-763235; AROD-8101-1-MC) Avail: NTIS CSCL 11/6

The effect of phase instability on plastic deformation was studied. The long range objective was to determine in what way martensitic and diffusional transformation during deformation may be used to improve the mechanical properties of high strength steel. Consideration will be given to the transformation of austenite under stress, to the acceleration of diffusional processes by cyclic loading and to the effect of these processes during low cycle fatigue of unstable stainless steel. The program was a careful study of the phase changes and the mechanisms of these changes which take place as a result of plastic deformation of steel, rather than the production of large quantities of empirical data. The results of the program are briefly summarized.
Author (GRA)

N73-31513# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
CORRELATION OF X-RAY AND ELECTRON MICROSCOPIC STUDIES OF FATIGUE Final Report, 1 Apr. 1970 - 31 Mar. 1973
J. Gerald Byrne 12 Jul. 1973 8 p refs
(Grant DA-ARO(D)-31-124-70-G57; DA-ARO(D)-31-124-72-G108)
(AD-764282; UTEC-MSE-73-127; AROD-8591-4-MC) Avail: NTIS CSCL 11/6

The fatigue behavior of Ni, Ni - 20% Co, and Ni 60 wt % Co alloys is closely related to their stacking fault energies (SFE) which decrease with increasing % Co. Transmission electron microscopy (TEM) showed that well defined regular subgrains formed in Ni, and progressively more irregular subgrains formed in the alloys as the SFE decreased. TEM subgrain sizes correlated within a factor of two with subgrain sizes previously determined by X-ray diffraction; i.e., approximately 1000 A by TEM and 500 A by X-ray. Scanning electron microscopy (SEM) showed that in pure Ni, cracks initiated among persistent slip bands in grain interiors while in the lower SFE alloys cracks tended to initiate in twin and grain boundaries. (Modified author abstract)
GRA

N73-31514# Watervliet Arsenal, N.Y.
HYDROSTATIC PRESSURE INDUCED DUCTILITY TRANSITIONS IN PURE BISMUTH AND TIN-BISMUTH ALLOYS
P. V. Dembowski, J. Pepe, and J. E. Davidson Jun. 1973 49 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-764241; R-WV-T-6-20-73) Avail: NTIS CSCL 11/6

The mechanical behavior of pure (99.999%) bismuth and tin-bismuth alloys of various compositions has been observed over a range of superimposed hydrostatic pressures. Results indicate that maxima in ductility (as measured by percent reduction in area at the fracture surface) in specimens tested at atmospheric pressure occur at compositions bordering pure tin and the eutectic composition. At sufficiently high pressures all compositions failed by rupture, i.e. necking to virtually 100% RA. For pure bismuth, pressure was observed to retard failure due to the formation of cracks at twin-grain boundary intersections; this result was consistent with the hypothesis that the effect of pressure is to shift the mode of crack propagation by decreasing the normal tensile component of stress acting on a crack.
Author (GRA)

N73-31515# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
SHAPE MEMORY EFFECT CHARACTERIZATION OF MODIFIED BETA-BRASS ALLOYS M.S. Thesis
Richard Charles Brilla Jun. 1973 40 p refs
(AD-764472) Avail: NTIS CSCL 11/6

Modified beta-brass alloys are tested at various temperatures to investigate the pseudoelastic and memory properties of the alloys. The effects of thermomechanical cycling, and prestrain of the beta-brass alloys are determined. A stress-strain relationship for the alloys at various test temperatures is developed.
Author (GRA)

N73-31516# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
ON THE MECHANISM OF DISPERSION STRENGTHENING, 1. STORED ENERGY MEASUREMENT IN DISPERSION STRENGTHENED IRON, 2 Final Report
Nicholas J. Grant, Donald Kenagy, and Stanley Wolf Jul. 1973 45 p ref
(Contract Nonr-3963(18))
(AD-764150) Avail: NTIS CSCL 11/6

A group of 42 copper base alloys containing 5 dispersoids (A12O3, SiO2, CoAl, Fe, and Mo) in amounts of 3, 7, and 11 percent, with particle sizes ranging from 0.01 to 25 microns (3 sizes in each alloy series), were prepared by powder blending. After extrusion at a reduction ratio of 6 to 1 at 745C, the alloys were tested for hardness, yield and tensile strength, ductility, and in stress rupture at 650C. In addition to the as-extruded condition, tests were also run on material annealed 10 hours at 650C. On average, all materials responded to the particle size and volume fraction of the dispersoid in the same direction, however, important differences in the extent and rate of the response were observed for both as-extruded and annealed materials, and in terms of metallic, intermetallic, or oxidic dispersions. The oxide dispersed alloys tend to behave as a cold worked copper matrix stabilized by a finely dispersed stable phase which does not interact directly with the matrix. The metallic dispersed alloys tend to behave as real alloys responding both to cold work and the effects of interactions between matrix and dispersoid. In this respect the insoluble Mo dispersoid produces a stronger, more stable alloy than does the soluble Fe dispersoid.
Author (GRA)

N73-31517# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE EROSIVE CHARACTERISTICS OF 2024 ALUMINUM ALLOY
G. Grant and W. Tabakoff Jun. 1973 49 p refs
(Grant DA-ARO(D)31-124-71-G154)
(AD-764267; Rept-73-37; AROD-10223-5-E) Avail: NTIS CSCL 11/6

The erosive characteristics of 2024 aluminum alloy have been experimentally examined. The parameters investigated included the particle approach angle, particle velocity, particle size, specimen length, particle material, particle concentration, and quantity of abrasive impacting the specimen. From this data an analytical model has been developed which will predict the erosion of this material.
Author (GRA)

N73-31518# Fairchild Industries, Inc., Farmingdale, N.Y. Fairchild-Republic Div.
DUCTILITY OF HEXAGONAL METALS WITH PARTICULAR APPLICATION TO TITANIUM AND BERYLLIUM Final Report, 1 May 1971 - 30 Apr. 1973
L. J. Teutonico Jun. 1973 9 p refs
(Contract F44620-71-C-0058; AF Proj. 9761)
(AD-763835; AFOSR-73-1118TR) Avail: NTIS CSCL 11/6

The subject of the study is an analytical investigation of deformation modes in hexagonal metals. The specific topics treated

are: stable Burgers vectors, dislocation interactions, and dislocation energy surfaces. The relationship of the results obtained to ductility (non-basal slip) and the formulation of a rationale for slip are discussed. Preliminary evidence is presented that efficient < c + a > slip is precluded a priori in beryllium.
Author (GRA)

N73-31519# Army Foreign Science and Technology Center, Charlottesville, Va.
USE OF NONLINEAR THEORY OF ELASTICITY FOR CALCULATION OF DEFORMATIONS OF MEASURING SYSTEM ELEMENTS IN HIGH PRESSURE DEVICES
S. S. Sekoyan and A. E. Eremeev 2 Nov. 1972 8 p refs Transl. into ENGLISH from Tr. Meteorol. Inst. (USSR), v. 164, no. 104, 1969 p 29-32
(AD-763971; FSTC-HT-23-1003-73) Avail: NTIS CSCL 11/6

Calculations are performed on the basis of the linear and nonlinear theory of elasticity to determine the deformation of a cylinder and piston made of heat-treated high-strength steel under the influence of high pressure. Author (GRA)

N73-31520# Office of Naval Research, London (England).
A LOOK AT STRONTIUM BARIUM METANIOBATE (STRAWBERRIES) AS AN ELECTRO-OPTIC CRYSTAL
William J. Condell and Alfred E. Victor 16 Apr. 1973 13 p
(AD-762740; ONRL-R-12-73) Avail: NTIS CSCL 20/6

A review of a talk given at the University College, London, on the topic of future electro-optic crystals is given. In particular, the physical characteristics of the oxygen-octahedra (O - O) crystal strontium barium metaniobate (Ba(x)Sr(1-x)Nb2 O6) are treated in detail and its potential for use as an electro-optic crystal is discussed. Ba(x)Sr(1-x)Nb2 O6, better known by its nickname, strawberries, is an attractive candidate for electro-optic use because its optical properties can be continuously varied over a wide range by varying the proportion of Ba and Sr in the crystal, and because it requires relatively small voltages for e-o operation. However, consistent growth of usable crystals is still a major problem. Author (GRA)

N73-31521# Army Materials and Mechanics Research Center, Watertown, Mass.
THERMAL EMBRITTLEMENT OF 4340 STEEL
Frank L. Carr and Thomas S. DeSisto Dec. 1972 19 p refs (DA Proj. 1T0-62105-A-328)
(AD-763900; AMMRC-TR-72-39) Avail: NTIS CSCL 11/6

Fracture appearance transition temperatures obtained with impact specimens were used to study the thermal embrittlement of 4340 steel between 950 and 1250 F (510 and 675 C). Embrittlement occurred at the higher temperatures but not in the vicinity of 1000 F within 16 days. The degree of embrittlement depended on both time and temperature. Reductions in toughness were correlated with changes in the morphology and size of ferrite grains as well as the size of carbide particles. These microstructural changes were similar to those observed in both 3140 and plain carbon steels by other investigators. Conventional anisothermal procedures used to produce temper brittleness in low alloy steels also embrittle these steels by another mechanism. Thus, the degradation of toughness attributed to temper brittleness results from two different modes of embrittlement. Transitional behavior previously described as the retrogression of temper brittleness is concluded to result from thermal embrittlement.
Author (GRA)

N73-31522# Naval Research Lab., Washington, D.C.
ACOUSTIC EMISSION FROM AQUEOUS STRESS CORROSION CRACKING IN VARIOUS TEMPERS OF 4340 STEEL Interim Report
H. H. Chaskelis, W. H. Cullen, and J. M. Krafft Jun. 1973 23 p refs
(AD-764048; NRL-MR-2608) Avail: NTIS CSCL 11/6

A commercially available system is employed to detect and count acoustic emissions emanating from the aqueous stress corrosion crack propagation in 4340 steel. Standard ASTM E399 compact tension specimens are prepared in four tempering temperatures: 204, 316, 427 and 538 C (400, 600, 800, 1000 F). Crack length is monitored with a notch opening clip gage. Comparisons show the time rate of emission events to increase with stress intensity in rough correspondence to, but much more rapidly than, the crack velocity. Tempering back tends to suppress the count rate as a warning of fast fracture instability. Some similarity is observed between the areal rate of acoustic emission and factors which influence degree and intensity of plastic flow instability in the fracture process zone.
Author (GRA)

N73-31523# Army Foreign Science and Technology Center, Charlottesville, Va.
STUDY OF DYNAMIC PROPERTIES OF METALS BY THE TRANSVERSE IMPACT METHOD
K. A. Kerimov and N. S. Gratskova 24 Jul. 1973 6 p refs Transl. into ENGLISH from the publ. "Rasprostranenie Uprugikh i Uprugoplastich" Uzebek, 1969 p 405-410
(AD-764105; FSTC-HT-23-2590-72) Avail: NTIS CSCL 11/6

The results of experimental studies on metal wires (brass and aluminum) are presented and stress-strain diagrams are plotted for these materials on the basis of the transverse impact method. GRA

N73-31524# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
CREVICE CORROSION OF A 70-30 CHROMIUM MODIFIED CUPRONICKEL AND ITS RELATIONSHIP TO THE EXPERIMENTAL POURBAIX DIAGRAM M.S. Thesis
James Michael Bowers Jun. 1973 134 p refs
(Contract N00014-68-A-0173-0015; DI-14-30-2600)
(AD-762596) Avail: NTIS CSCL 11/6

Using potentiostatic testing methods the range of crevice corrosion susceptibility of four chromium modified 70-30 cupronickel alloys containing various solute metals was determined in 0.1 molar chloride solutions. In addition, experimental potential-pH diagrams were constructed for the same alloys using data from potentiokinetic tests. These diagrams were refined using potentiostatic testing in the region of the immunity line and potentiostatic titrations near vertical lines. The crevice corrosion results were then related to the Pourbaix diagrams and interpreted on an electrochemical basis. Prepassivation tests also were conducted in which the samples were first potentiostated in a passive region and then in an active region. (Modified author abstract) GRA

N73-31525# Bureau of Mines, Washington, D.C.
LIQUID STATE SPECTRAL EMISSIVITIES OF TITANIUM, VANADIUM, ZIRCONIUM, MOLYBDENUM, AND PLATINUM IN AN ELECTRON-BEAM FURNACE
R. K. Koch, J. L. Hoffman, and R. A. Beall May 1973 31 p refs
(PB-221526/7; BM-RI-7743) Avail: NTIS HC $3.00 CSCL 11F

The determination of thermochemical data for the transition metals at temperatures above their melting points is a part of the Bureau's metallurgical program designed to provide useful data for the secondary metals, metal winning, and metal processing industries. The long-range objectives are to promote the recycling of scrap metal, conserve domestic resources, and lower the cost of metal products. The normal spectral emissivities of titanium, vanadium, zirconium, molybdenum, and platinum were determined for the liquid state. The determinations were made at an effective wavelength of 658 millimicrons for all of the metal except molybdenum (657)millimicrons). Two-color temperatures were used to approximate the true temperature for substitution in Wien's equation. Brightness temperature was measured with a micro-optical pyrometer. GRA

N73-31526# British Steel Corp., London (England). Strip Mills Div.
THE CONCEPT OF ISO-TEMPERATURE CONTOURS IN RECRYSTALLIZATION STUDIES
C. Dasarathy Apr. 1973 5 p ref
(PB-221302/3; BISRA-SM/TN/A/1076) Avail: NTIS HC $3.00 CSCL 11F

The note describes an easy method of interpreting certain experimental data from recrystallization and ageing studies.
GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-31527 Lehigh Univ., Bethlehem, Pa.
PRESSURE-SINTERING KINETICS AND MECHANICAL PROPERTIES OF HIGH-PURITY, FINE-GRAINED MULLITE Ph.D. Thesis
Robert Anthony Penty 1972 172 p
Avail. Univ. Microfilms Order No. 73-10941

Pressure sintering and creep kinetics, elastic behavior and strength of fine grain, high purity mullite were studied. The room temperature strength of mullite near theoretical density was in the range 32,000 to 38,000 psi. Gas polishing improved the strength to 50,000 psi. Increasing the porosity from 0.60 to 10.16 percent made the strength decrease less sensitive to temperature in the range room temperature to 1000 C. A strength maximum of 34,000 psi was obtained at 1200 C with 0.60 percent porosity compared to a strength of 30,400 psi at 900 C with 4.33 percent porosity. The fracture mode at room temperature and high temperature was essentially intergranular with a small percentage of transgranular. Dissert. Abstr.

N73-31528 Washington Univ., St. Louis, Mo.
THE EFFECTS OF ENVIRONMENT ON THE MORPHOLOGY AND MECHANICAL PROPERTIES OF UNFILLED AND GRAPHITE-REINFORCED POLYSULFONE AND POLY (2,6-DIMETHYL) PHENYLENE OXIDE Ph.D. Thesis
Kuei-Hsiung Yang 1972 235 p
Avail: Univ. Microfilm Order No. 73-11827

The effects of environment on the morphology and mechanical properties of unfilled and graphite-reinforced polysulfone and poly(2,6-dimethyl) phenylene oxide (PPO) have been characterized in order to investigate the possibility of tailoring the interface in both polysulfone/graphite and PPO/graphite composites by means of environmental treatments to produce superior performance properties. The mechanical properties of both polysulfone/graphite and PPO/graphite composite are moderately affected by thermal treatments. Dissert. Abstr.

N73-31529*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SENSITIVITY AND COMPARISON EVALUATION OF SATURN 5 LIQUID PENETRANTS
G. H. Jones 27 Jul. 1973 53 p refs
(NASA-TM-X-64769) Avail: NTIS HC $4.75 CSCL 11D

Results of a sensitivity and comparison evaluation performed on six liquid penetrants that were used on the Saturn 5 vehicle and other space hardware to detect surface discontinuities are described. The relationship between penetrant materials and crack definition capabilities, the optimum penetrant materials evaluation method, and the optimum measurement methods for crack dimensions were investigated. A unique method of precise developer thickness control was envolved, utilizing clear radiographic film and a densitometer. The method of evaluation included five aluminum alloy, 2219-T87, specimens that were heated and then quenched in cold water to produce cracks. The six penetrants were then applied, one at a time, and the crack indications were counted and recorded for each penetrant for comparison purposes. Measurements were made by determining the visual crack indications per linear inch and then sectioning the specimens for a metallographic count of the cracks present. This method provided a numerical approach for assigning a sensitivity index number to the penetrants. Of the six penetrants evaluated, two were not satisfactory (one was not sufficiently sensitive and the other was to sensitive, giving false indications). The other four were satisfactory with approximately the same sensitivity in the range of 78 to 80.5 percent of total cracks detected. Author

N73-31530*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
INVESTIGATION OF HIGH TEMPERATURE FRACTURE OF T-111 AND ASTAR-811C Final Report
R. E. Gold Apr. 1971 100 p refs
(Contract NAS3-11827)
(NASA-CR-72859; WANL-PR(VVV)-003) Avail: NTIS HC $7.50 CSCL 11D

The high temperature deformation and fracture behavior of T-111 and ASTAR-811C were studied over the temperature range 982 to 2205 C (1800 to 4000 F). As-cast and wrought-recrystallized material as well as GTA welds in sheet and plate were evaluated using conventional tensile and creep tests. Post test examinations were performed using optical metallography, scanning electron microscopy and transmission electron microscopy. A high temperature region of reduced ductility, in terms of tensile elongation, was identified for both alloys. The reduction in tensile elongation became more severe with increase in grain size, being near catastrophic for the as-cast specimens. Optical and electron metallography indicated that even for failures at very low total strain, considerable deformation of a very localized nature had occurred prior to fracture. Author

N73-31531# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL INVESTIGATION OF ANTIFRICTION PROPERTIES OF MATERIALS BASED ON POLYFLUOROETHYLENE RESIN AT LOW TEMPERATURES
A. M. Arkharov and L. D. Kharitonova 1972 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved, Mashinostr. (Moscow), no. 7, 1973 p 122-126
Avail: NTIS HC $3.00; National Translations Center, John Crerar Libarary, Chicago, Illinois 60616

A method of testing materials based on teflon and Kel-F for friction at low temperatures by using X18H9T steel in a helium medium for different slip rates and loads is described. Values of the friction coefficients of these pairs of materials calculated by means of experimental results are presented. A number of structural elements of refrigeration machines, microcooler, piston expanders, and other low-temperature machines and apparatus operate under dry friction conditions. An investigation of the antifriction properties of materials used in the dry friction components of these machines was carried out with an exact imitation of their actual operating conditions. The experimental data obtained uphold the conclusion of the predominant influence of the temperature on the friction coefficient of materials containing a polyfluoroethylene resin during work on stainless steel in a helium medium. Author

N73-31532*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Research and Engineering Dept.
DEVELOPMENT OF ADVANCED MATERIALS COMPOSITES FOR USE AS INSULATIONS FOR LH2 TANKS Final Report, May 1972 - Apr. 1973
C. R. Lemons and O. K. Salmassy Apr. 1973 101 p refs
(Contract NAS8-25973)
(NASA-CR-124388; MDC-G4492) Avail: NTIS HC $7.25 CSCL 11D

A study of thread-reinforced polyurethane foam and glass fabric liner, serving as internally bonded insulation for space shuttle LH2 tanks, is reported. Emphasis was placed on an insulation system capable of reentry and multiple reuse in the shuttle environment. The optimized manufacturing parameters associated with each element of the composite are established and the results, showing successful completion of subscale system evaluation tests using the shuttle flight environmental requirements, are given. Author

N73-31533*# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
DEVELOPMENT OF HIGH TEMPERATURE SILICONE ADHESIVE FORMULATIONS FOR THERMAL PROTECTION SYSTEM APPLICATIONS Final Report, 12 Jan. 1972 - 12 Mar. 1973
Ralph R. Hockridge May 1973 116 p refs
(Contract NAS8-28113)
(NASA-CR-124389) Avail: NTIS HC $8.00 CSCL 11A

Trade-off studies and screening evaluations were made of commercial polymers and silicone foam sheet stock. A low modulus, low density 0.26 gm/cc modification was developed of the GE-RESD PD-200 system based upon GE RTV-560 silicone polymer. The bond system modification was initially characterized for mechanical and thermal properties, evaluated for application

methods, and its capability demonstrated as a strain arrestor bond system. D.L.G.

N73-31534# Rutherford High Energy Lab., Chilton (England).
IMPREGNATION OF SUPERCONDUCTING WINDINGS WITH EPOXY RESINS. PART 2: RESIN DATA
A. J. Middleton, P. D. Hey, and B. Colyer Dec. 1972 48 p refs
(RHEL/R-265-Pt-2) Avail: AEC Depository Libraries HC $4.50; HMSO 50p; PHI $2.15

Mechanical properties data are given for a number of epoxy resins which were tested, both at room temperature and at liquid helium temperature. Author (NSA)

N73-31535# Pennsylvania State Univ., University Park. Materials Research Lab.
NONLINEAR ELASTIC AND THERMOELASTIC PROPERTIES OF HIGH TEMPERATURE MATERIALS Final Report, 1 Jun. 1968 - 31 Mar. 1972
G. R. Rarsch Apr. 1973 25 p refs
(Contract AT(11-1)-3418)
(COO-3418-9) Avail: NTIS HC $3.25

The pressure dependence of the single-crystal elastic constants was measured at 300 K for RbCl, RbBr, RbI, NaI, KI, wurtzite, and UO2 between 300 and 500 K for CsI, between 37 and 300 K for V3Si, and between 13 and 300 K for V3Ge. Except for UO2 and for the longitudinal moduli in wurtzite, the pressure dependence was found to be nonlinear in the pressure range up to about 4 kbar for the rubidium halides, or 10 kbar for the other materials. The complete set of third-order elastic constants was measured at 300K for UO2 single crystals, Al2O3 single crystals, and Al2O3 polycrystals. For vitreous silica, the complete sets of third- and fourth-order elastic constants were measured at room temperature. The results for most of the nonmetallic materials could be satisfactorily explained on the basis of the rigid ion model (alkalihalides) and the shell model (UO2). In general, good to fair agreement between calculated and measured qualities was obtained. NSA

N73-31536# Aeronautical Quality Assurance Directorate, Uxbridge (England).
METHODS OF MEASUREMENT OF THE RELATIVE PERFORMANCE OF VARIOUS CLASSES OF RESINS IN CARBON FIBRE COMPOSITES
L. J. Artis and J. C. Joiner 1 Oct. 1972 29 p refs
(AQD/NM-000198; BR-34371) Avail: NTIS HC $3.50

Carbon fiber composites were made using a variety of resin types, including epoxy, phenolic, polyimide, and polyester; these were assessed according to their interlaminar shear strength, flexural, and transverse tensile strengths. An attempt was made to correlate these results with the wetting characteristics of the various resins and also with the void content and distribution as determined by stereo-microradiography. ESRO

N73-31537# Naval Research Lab., Washington, D.C.
PHYSICS AND CHEMISTRY OF GLASSES Final Report
Robert J. Ginther, Russell D. Kirk, John H. Konnert, George A. Ferguson, Jerome Karle, Stephen G. Bishop, David L. Griscom, Dean L. Mitchell, Anthony R. Ruffa, George H. Sigel et al May 1973 227 p refs
(ARPA Order 2029; NRL Proj. 64P03-07A)
(AD-763338; NRL-MR-2590) Avail: NTIS CSCL 11/2

The report is a summary of glass research undertaken during a five year period (1967-72) under the sponsorship of the Advanced Research Projects Agency. Research areas which are reviewed include structure of glasses, synthesis and preparation of glasses, electronic structure of silica, ultraviolet spectra of silicate glasses, electron spin resonance in borate glasses, structural and electrical properties of chalcogenide glasses and ion bombardment effects on the strength of glass.
Author (GRA)

N73-31538# Grumman Aerospace Corp., Bethpage, N.Y.
THE BEHAVIOR OF ADVANCED FILAMENTARY COMPOSITE PLATES WITH CUTOUTS Final Technical Report, Mar. 1970 - Sep. 1972
James B. Whiteside, Isaac M. Daniel (IIT Res. Inst.), and Robert E. Rowlands (IIT Res. Inst.) Jun. 1973 175 p refs
(Contract F33615-70-C-1308; AF Proj. 4364)
(AD-764362; AFFDL-TR-73-48) Avail: NTIS CSCL 11/4

The results of an analytical and experimental program to investigate the behavior of advanced composite plates with cutouts are presented. Classical and numerical analyses of anisotropic plates are compared with data from composite panels instrumented with strain gages, photoelastic coatings and moire fringe multiplication techniques. A finite element analysis program is used to examine elastic and plastic interlaminar shear at free edges in composite laminates. The behavior of fiberglass-epoxy, and boron-epoxy laminates with holes is examined for uniaxial and biaxial tension. The compressive behavior of graphite-epoxy and boron-epoxy laminates with holes is discussed. Test and analysis results for boron-epoxy laminates demonstrate the influence of such variables as fiber orientation, stacking sequence, load history, hole roughness, hole shape, diameter/width ratio, diameter/thickness ratio, loading rate, and hole reinforcement. Data and recommendations for design are discussed.
Author (GRA)

N73-31539# Rutgers Univ., New Brunswick, N.J. Dept. of Ceramics.
DETERMINATION OF POISSON'S RATIO FOR VARIOUS GLASS SYSTEMS Final Report, 1 Sep. 1971 - 31 Aug. 1972
Charles J. Phillips, Harold T. Smyth, and Christopher W. Kopf Jun. 1973 30 p refs
(Contract N00019-71-C-0113)
(AD-764080) Avail: NTIS CSCL 11/2

Glasses were prepared containing soda and silica alone and with additions of CaO, BaO, ZnO and B2O3. The effect of Al2O3 additives to these glasses was also studied as well as additions of ZrO2. This was in an attempt to learn what each of these oxides does to the elastic properties as a guide in choosing suitable glass compositions for particular applications. GRA

N73-31540# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
CHARACTERIZATION OF COMPOSITES FOR THE PURPOSE OF RELIABILITY EVALUATION Technical Report, Dec. 1969 - Dec. 1972
John C. Halpin, Kenneth L. Jerina, and Thomas A. Johnson Dec. 1972 103 p refs
(AF Proj. 7342)
(AD-764356; AFML-TR-72-289) Avail: NTIS CSCL 11/4

The report discusses, develops, and experimentally verifies models for composite material behavior. These models include a description of static failure resistance by lamination theory combined with energy based fracture mechanics criterion for failure, and a description of wearout via kinetic fracture mechanics. The relationships between the material's capability as defined by these models and the anticipated use and misuse reflected by the expected loads and environments is defined and implemented. The goal is to define critical technical areas for the development of structural composites. GRA

N73-31541# Naval Academy, Annapolis, Md.
A STUDY ON FRACTURE TOUGHNESS OF ADVANCED STRUCTURAL COMPOSITES Final Report, 15 Feb. 1972 - 23 Apr. 1973
George C. Chang Jul. 1973 113 p refs
(AD-764070; EW-4-73) Avail: NTIS CSCL 11/4

The basic concept of structural fracture in homogeneous, isotropic materials is discussed. Fundamental relationships associated with the linear elastic fracture mechanics, based on the Griffith-Irwin approach, are presented. Discussed next are properties of fiber reinforced (or filamentary) composite materials from fracture mechanics point of view. Representative fracture test results are then reviewed and analyzed. Involved in the tests are numerous composites such as beryllium/aluminum, glass/epoxy, Scotchply, boron/aluminum, graphite/polyimide, etc. Some of these nonhomogeneous anisotropic composites are unidirectionally reinforced, while other are angle-plied. Finally, the fracture phenomenon and process in filamentary composites are discussed in details. It was found that the linear elastic fracture mechanics is applicable to most composite materials which have been investigated. Also presented are recommendations for future work on fracture of structural composites intended

for high-performance flight vehicles. (Modified author abstract) GRA

N73-31542# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICOCHEMICAL PRINCIPLES OF PRODUCING GLASS PARTS FROM POLYMETHYLMETHACRYLATE ORGANIC GLASS WITH HIGH RELIABILITY AND THE REQUIRED SAFE LIFE
M. M. Gudimov 7 Jun. 1973 13 p Transl. into ENGLISH from Ekspluatatsionnaya Nadezhnost, Kach. Svoistva Samoletnogo Organ. Stekla (USSR), no. 177, 1971 p 9-17
(FTD Proj. 60107)
(AD-763282; FTD-HT-23-434-73) Avail: NTIS CSCL 11/9

Stress and temperature tests were conducted on CO-120 organic glass to reveal the mechanical properties. Visible cracks were a function of the magnitude of the tensile stresses. New methods for attaching the glass to the apparatus involved were developed. A clamping device and a synthetic fiber holding band are used, eliminating the need to drill holes in the glass, the use of nuts and bolts, the added stress of the old method. T.M.R.

N73-31543# Naval Research Lab., Washington, D.C.
CRACK PROPAGATION STUDIES IN BRITTLE MATERIALS Interim Report
S. W. Freiman, D. R. Mulville, and P. W. Mast 3 Jul. 1973 21 p refs
(AD-764045; NRL-7575) Avail: NTIS CSCL 11/2

An analysis was made of cantilever-beam specimens subjected to end loads and moments for use in crack propagation studies. Included in this analysis were the effects of a plastic zone at the crack tip, beam rotation, and the viscoelastic response of the material. This analysis showed that application of a bending moment to the specimen rather than an end load provides a test in which the strain energy release rate is independent of crack length. Other advantages of this test configuration are that corrections for both shear and beam-rotation effects are not necessary. Results of this test on both glass and ceramics are reported. Author (GRA)

N73-31544# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROLYTIC AND CERTAIN OTHER METHODS FOR APPLYING TITANIUM COATING
G. A. Kolobov 29 Jun. 1973 18 p refs Transl. into ENGLISH from Sb. Tr., Met. Khim. Titana (USSR), v. 5, 1970 p 66-75
(AD-764318; FTD-HT-23-450-73) Avail: NTIS CSCL 11/3

The Russian report presents a brief discussion of methods for applying protective titanium coatings. GRA

N73-31545# Army Construction Engineering Research Lab., Champaign, Ill.
LIME-CEMENT COMBINATION STABILIZATION
Lovick P. Suddath May 1973 41 p refs
(AD-762552; CERL-TM-M-47) Avail: NTIS CSCL 13/2

Soil stabilization is used extensively in road and airfield construction. In particular, soil-cement appears to be a favorite among the engineers. As the plasticity of a soil increases, the ability to adequately mix the cement with the soil becomes a critical factor. Also the quantity of cement required to stabilize the soil becomes excessive. The objective of the study was to determine the effect of reduced compacted density on the durability of cement stabilized clays, pretreated with lime. The reduction in density did not impair the durability of cement stabilized clay soils, which were pretreated with lime. Most of the test results indicated an improved resistance to freeze-thaw. An evaluation of the unconfined compressive strength results obtained during freeze-thaw shows that lime pretreatment improved the strengths. (Modified author abstract) GRA

N73-31546# National Science Foundation, Washington, D.C.
NSF HARD MATERIALS RESEARCH, VOLUME 1
1972 445 p refs Presented at the 3rd Semi-Annual Industry-University Workshop, Univ. Park, Pa., 10-11 Jul. 1972 Prepared in cooperation with Penn. State Univ., Univ. Park, Pa.
(PB-221907/9) Avail: NTIS HC $10.60 Also available as set of two reports PB-221906-SET $22.00 CSCL 11K

Research in the area of hard materials and materials removal processes from the participating universities is reported. It includes the proceeding of the third semi-annual industry-university workshop. GRA

N73-31547# National Science Foundation, Washington, D.C.
NSF HARD MATERIALS RESEARCH, VOLUME 2
R. Komanduri, M. C. Shaw, and Nam P. Suh 1 Jul. 1973 677 p refs Presented at the 3rd Semi-Ann. Industry-University Workshop, University Park, Pa., 10-11 Jul. 1972 Prepared in cooperation with MIT, Cambridge
(Grant NSF GK-29361)
(PB-221908/7) Avail: NTIS HC $12.50 Also available as set of two reports PB-221906-set $22.00 CSCL 11K

Research in the area of hard materials and materials removal processes is reported, representing research performed at the participating universities. GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-31548 Illinois Inst. of Tech., Chicago.
ON THE OPTIMAL COMPENSATION OF LINEAR MULTIVARIABLE SYSTEMS WITH STRUCTURALLY CONSTRAINED DYNAMIC COMPENSATORS Ph.D. Thesis
Reza Ahmari 1972 162 p
Avail: Univ. Microfilms Order No. 73-12195

The compensation is studied of linear time invariant, deterministic systems, as well as certain classes of nonlinear systems. The problem of pole assignment with incomplete state feedback is generalized. It is shown that by using a fixed order compensator, a unique maximum number of eigenvalues of the closed loop system can be preassigned arbitrarily. An algorithm for solving the problem of pole assignment with output feedback, is developed. The problem of approximate pole placement in linear time invariant systems, is investigated. It is shown how a low order compensator may be obtained such that the eigenvalues of the closed loop system are close to a set of preassigned values. Optimal compensation of linear stationary multivariable systems is studied for the case in which the compensator order and structure are constrained. A method is developed which can be used in optimizing those systems which have adjustable parameters in the plant and/or the compensator. Dissert. Abstr.

N73-31549 California Univ., Irvine.
ON THE CHOICE OF A SYSTEM AND SENSOR CONFIGURATION FOR OPTIMAL LINEAR ESTIMATION Ph.D. Thesis
Robert Grover Rains 1972 170 p
Avail: Univ. Microfilms Order No. 73-11658

A system and sensor configuration control problem is formulated for a class of linear stochastic systems corrupted by Gaussian noise. The criterion function is a scalar measure of the terminal or steady state error covariance matrix for the optimal linear estimator of the state of the system. A set of necessary conditions for optimality of a configuration control sequence is derived. The time-invariant case is examined in detail. A scalar example is solved analytically and a numerical algorithm is presented for the vector case. The time-varying problem with linear constraints is considered and two numerical methods of optimization are presented. One is based on a parameter optimization approach, while the other is adapted from an optimal control algorithm. The parameter optimization approach is applied to a problem of optimal missile launcher control while estimating the relative alignment of two inertial instrument packages. Dissert. Abstr.

N73-31550*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
THE USE OF THE MODIFIED CHOLESKY DECOMPOSITION IN DIVERGENCE AND CLASSIFICATION CALCULATIONS
D. L. VanRooy, M. S. Lynn, and C. H. Snyder May 1973 80 p refs

(Contract NAS9-12776)
(NASA-CR-133990; ICSA-275-025-008) Avail: NTIS HC $6.00 CSCL 12A

The use of the Cholesky decomposition technique is analyzed as applied to the feature selection and classification algorithms used in the analysis of remote sensing data (e.g. as in LARSYS). This technique is approximately 30% faster in classification and a factor of 2-3 faster in divergence, as compared with LARSYS. Also numerical stability and accuracy are slightly improved. Other methods necessary to deal with numerical stablity problems are briefly discussed. Author

N73-31551*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
SPLINE SMOOTHING OF HISTOGRAMS BY LINEAR PROGRAMMING
John O. Bennett Sep. 1972 30 p refs
(Contract NAS9-12776)
(NASA-CR-133987; ICSA-275-025-002) Avail: NTIS HC $3.50 CSCL 12A

An algorithm for an approximating function to the frequency distribution is obtained from a sample of size n. To obtain the approximating function a histogram is made from the data. Next, Euclidean space approximations to the graph of the histogram using central B-splines as basis elements are obtained by linear programming. The approximating function has area one and is nonnegative. Author

N73-31552*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
POWER SPECTRAL DENSITY ESTIMATION BY SPLINE SMOOTHING IN THE FREQUENCY DOMAIN
R. J. P. deFigueiredo (Wisconsin Univ.) and J. R. Thompson Sep. 1972 13 p refs
(Contract NAS9-12776)
(NASA-CR-133986; ICSA-275-025-004) Avail: NTIS HC $3.00 CSCL 12A

An approach, based on a global averaging procedure, is presented for estimating the power spectrum of a second order stationary zero-mean ergodic stochastic process from a finite length record. This estimate is derived by smoothing, with a cubic smoothing spline, the naive estimate of the spectrum obtained by applying FFT techniques to the raw data. By means of digital computer simulated results, a comparison is made between the features of the present approach and those of more classical techniques of spectral estimation. Author

N73-31553*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
A RANDOM NUMBER GENERATOR FOR CONTINUOUS RANDOM VARIABLES
Victor M. Guerra, R. A. Tapia, and James R. Thompson Sep. 1972 11 p refs
(Contract NAS9-12776)
(NASA-CR-133983; ICSA-275-025-007) Avail: NTIS HC $3.00 CSCL 12A

A FORTRAN 4 routine is given which may be used to generate random observations of a continuous real valued random variable. Normal distribution of F(x), X, E(akimas), and E(linear) is presented in tabular form. Author

N73-31554*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
A GEOMETRICAL INTERPRETATION OF THE 2n-th CENTRAL DIFFERENCE
R. A. Tapia Sep. 1972 5 p refs
(Contract NAS9-12776)
(NASA-CR-133985; ICSA-275-025-005) Avail: NTIS HC $3.00 CSCL 12A

Many algorithms used for data smoothing, data classification and error detection require the calculation of the distance from a point to the polynomial interpolating its 2n neighbors (n on each side). This computation, if performed naively, would require the solution of a system of equations and could create numerical problems. This note shows that if the data is equally spaced, then this calculation can be performed using a simple recursion formula. Author

N73-31555*# Rice Univ., Houston, Tex. Inst. for Computer Services and Application.
A MATHEMATICAL MODEL CONCERNING REFLECTANCE FROM A ROW CROP
R. K. Jaggi Sep. 1972 22 p refs
(Contract NAS9-12776)
(NASA-CR-133989; ICSA-275-025-001) Avail: NTIS HC $3.25 CSCL 02C

The recent work of Allen, Gayle, and Richardson (1970) and Suits (1972) has been extended to compute directional reflectance from a crop row. A model is constructed which takes into account edge effects and aids in discriminating crops with leaf orientation in preferred directions. This report only contains the development of the mathematical equations. Numerical results will be published in a forthcoming report. Author

N73-31556# National Bureau of Standards, Washington, D.C.
TABLES OF TWO-ASSOCIATE-CLASS PARTIALLY BALANCED DESIGNS
Willard H. Clatworthy (State Univ. of N. Y., Buffalo), Joseph M. Cameron, and Janace A. Speckman May 1973 323 p refs
(NBS-AMS-63) Avail: HC $3.45 Domestic Postpaid or $3.00 GPO Bookstore as C13.32:63

An enlarged and revised set of tables based on tables of partially balanced designs with two associate classes is presented. Approximately 950 combinatorially distinct designs are given, which represents a doubling of the number of parametric specifications for designs of the original publication. The introduction includes special instructions to aid analysis using hand calculations and a section on the general least-squares approach for use when the analysis is to be done on an electronic computer. Information is provided on methods of construction, and extensive references, including original sources for the designs, are given. A tabulation of known information about uniqueness, resolvability and the nature of the corresponding dual and complementary designs is also included for each design. Author

N73-31557*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEPARATION OF VARIABLES IN THE SPECIAL DIAGONAL HAMILTON-JACOBI EQUATION: APPLICATION TO THE DYNAMICAL PROBLEM OF A PARTICLE CONSTRAINED ON A MOVING SURFACE
David L. Blanchard and F. K. Chan (Catholic Univ. of America) Washington Sep. 1973 70 p refs
(NASA-TR-R-405; G-1077) Avail: NTIS HC $3.50 CSCL 12A

For a time-dependent, n-dimensional, special diagonal Hamilton-Jacobi equation a necessary and sufficient condition for the separation of variables to yield a complete integral of the form was established by specifying the admissible forms in terms of arbitrary functions. A complete integral was then expressed in terms of these arbitrary functions and also the n irreducible constants. As an application of the results obtained for the two-dimensional Hamilton-Jacobi equation, analysis was made for a comparatively wide class of dynamical problems involving a particle moving in Euclidean three-dimensional space under the action of external forces but constrained on a moving surface. All the possible cases in which this equation had a complete integral of the form were obtained and these are tubulated for reference. Author

N73-31558# Lockheed Missiles and Space Co., Palo Alto, Calif.
PARTICULAR CHARACTERISTICS OF TRACKING DISTRIBUTION
G. V. Brezkov and V. D. Razevig 1972 16 p Transl. into ENGLISH from the publ. "Metody Analiza Sryva Slazheniia" Moscow, Sov. Radio, 1972
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Characteristics of tracking disruptions are computed. The critical noise power is determined by statistical linearization and critical disruption conditions are determined on the basis of the Pontryagin equation. K.M.M.

N73-31559*# California State Coll., Fullerton. Dept. of Mathematics.

ANALYSIS AND OPTIMIZATION OF CYCLIC METHODS IN ORBIT COMPUTATION
S. Pierce Feb. 1973 24 p refs
(Grant NGR-05-071-005)
(NASA-CR-132806; TR-05-071-005-1) Avail: NTIS HC $3.25 CSCL 12A

The mathematical analysis and computation of the K=3, order 4; K=4, order 6; and K=5, order 7 cyclic methods and the K=5, order 6 Cowell method and some results of optimizing the 3 backpoint cyclic multistep methods for solving ordinary differential equations are presented. Cyclic methods have the advantage over traditional methods of having higher order for a given number of backpoints while at the same time having more free parameters. After considering several error sources the primary source for the cyclic methods has been isolated. The free parameters for three backpoint methods were used to minimize the effects of some of these error sources. They now yield more accuracy with the same computing time as Cowell's method on selected problems. This work is being extended to the five backpoint methods. The analysis and optimization are more difficult here since the matrices are larger and the dimension of the optimizing space is larger. Indications are that the primary error source can be reduced. This will still leave several parameters free to minimize other sources. Author

N73-31560# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
QUASI-NEWTON METHODS FOR LINEARLY CONSTRAINED OPTIMIZATION
P. E. Gill and W. Murray May 1973 38 p refs
(NPL-NAC-32) Avail: NTIS HC $4.00

To produce a quasi-Newton algorithm for linearly constrained optimization two methods are combined. They include a quasi-Newton method based on recurring the Cholevsky factorization of an approximation to the Hessian matrix of second derivatives, and a method based upon the recurrence of triangular factorization for handling linear constraints. ESRO

N73-31561# Weibull (Waloddi), Lausanne (Switzerland).
THE CONCEPT OF PSEUDO-STANDARDIZED VARIABLES AND ITS USE AS ELEMENTS OF SHAPE OPERATORS Report for 1 Feb. 1971 - 31 May 1972
Waloddi Weibull Jul. 1973 44 p refs
(Contract F44620-72-C-0028; AF Proj. 7351)
(AD-764361; AFML-TR-73-98) Avail: NTIS CSCL 12/1

The concept of pseudo-standardized variable is explained and the fundamental properties of this variable are indicated. Its most important property of being scale and location invariant makes it useful as elements of shape operators, and its space being equal to closed interval (0,1) has practical advantages. Four types of shape operators are defined and examined. Twenty-five tables which simplify their practical applications have been prepared and are presented. Two examples concerning data of rotating beam fatigue performance illustrate the different numerical procedures. Author (GRA)

N73-31562# Alabama Univ., Huntsville. School of Graduate Studies and Research.
ON DUAL-COMPLEMENTARY VARIATIONAL PRINCIPLES IN MATHEMATICAL PHYSICS
J. T. Oden and J. N. Reddy Feb. 1973 51 p refs
(Contract F44620-69-C-0124; AF Proj. 9560)
(AD-763837; UAH-RR-142; AFOSR-73-1140TR) Avail: NTIS CSCL 12/1

A study of boundary value problems involving T^*T-operators is given. Problems in mathematical physics can be decomposed into 3 canonical equations. Variational principles can be developed corresponding to these equations. Likewise, for any operator T one can construct a dual pair of operators S^*S. A dual system of canonical equations can be developed with corresponding variational principles. Consequently, a set of 8 complementary and dual complementary variational principles suggest themselves. A number of applications are cited, together with extensions of nonlinear problems. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-31563 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 127, NO. 2: THE THERMAL MICROWAVE RADIATION OF THE EARTH ATMOSPHERE AND THE SIGNIFICANCE FOR METEOROLOGY [METEOROLOGISCHE ABHANDLUNGEN. BAND 127, HEFT 2: DIE THERMISCHE MIKROWELLENSTRAHLUNG DER ERDATMOSPHAERE UND IHRE BEDEUTUNG FUER DIE METEOROLOGIE]
Dirk Koslowsky 1973 53 p refs In GERMAN; ENGLISH summary
Copyright. Avail: Issuing Activity

The basic elements for applying spectroscopic methods on remote sensing of the earth's atmosphere in the range of microwaves are descussed. Special consideration is given to the structure of microwave spectra of molecular oxygen and hydrogen. The radiative transfer in the earth's atmosphere is analyzed. Inversion techniques are given for the derivation of meteorological parameters from radiation measurements, followed by examples and methods of application. Author

N73-31564 Michigan Univ., Ann Arbor.
THE INTERACTION OF INTERNAL GRAVITY WAVES AND ATMOSPHERIC WINDS WITH SHEAR Ph.D. Thesis
Keith Laverne Bekofske 1972 171 p
Avail: Univ. Microfilms Order No. 73-11037

The interaction between an atmospheric internal gravity wave and a mean horizontal wind with shear is investigated. A two-dimensional, monochromatic internal gravity wave propagating in a linear shear flow is considered. The atmosphere is assumed to be isothermal and incompressible and to satisfy the Boussinesq approximation. Various intensities of ambient turbulence are allowed. The wave-wind interaction provides a physical process by which momentum is transferred from the internal gravity wave to the background mean wind near a critical level. The momentum transfer mechanism is investigated by including a model source term in the perturbed equation of motion which reflects the conservation of mean horizontal momentum. The resulting model equation of interaction is nonlinear and an iterative technique is used to obtain numerical solutions. Dissert. Abstr.

N73-31565# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 6, JUNE 1973
5 Sep. 1973 122 p refs Transl. into ENGLISH of Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 130 p
(JPRS-59962) Avail: NTIS HC $8.25

Research is reported on (microclimatology, agricultural meteorology, weather forecasting and climate control, hydrological forecasting, and the activities of the Soviet Hydrometeorological Service. For individual titles, see N73-31566 through N73-31575.

N73-31566 Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR THE DEVELOPMENT OF THE USSR HYDROMETEOROLOGICAL SERVICE
Ye. K. Fedorov *In its* Meteorology and Hydrol. No. 6 Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 1-15 Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 3-14
(For availability see N73-31565 22-20)

Some results of the development of the U.S.S.R. Hydrometeorological Service and individual deficiencies in its growth are discussed. A forecast of the basic features of the development of the service to the year of 1990 is presented. Author

N73-31567 Joint Publications Research Service, Arlington, Va.
THREE TEN-DAY SYNOPTIC-HYDRODYNAMIC-STATISTICAL WEATHER FORECASTING SCHEME
A. L. Kats *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 16-29 refs Transl. into ENGLISH

from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 15-25 (For availability see N73-31565 22-20)

The fundamentals of a synoptic-hydrodynamic-statistical procedure for three-ten day forecasting of meteorological elements are discussed. The new procedure for five and ten day forecasting of the mean air temperature for all seasons of the year successfully passed operative testing in 1972 and was approved by the Central Procedural Commission of the main administration of the Hydrometeorological Service for introduction into practice. The tests demonstrated the particular success of the procedure in cases of sharp variations of the weather conditions. Author

N73-31568 Joint Publications Research Service, Arlington, Va.
CELLULAR CONVECTION PARAMETERS BY OBSERVATIONS FROM METEOROLOGICAL EARTH SATELLITES AND A HIGH ALTITUDE TOWER
L. I. Petrova *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 30-42 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 26-35 (For availability see N73-31565 22-20)

It is demonstrated that the dimensions of the mesoscale nonuniformities in the spectra of the meteorological elements in the lower 300 meter layer of the atmosphere, obtained by the measurements on a high-altitude tower of the Institute of Experimental Meteorology (Obninsk), are close to the characteristic dimensions of the cumulus clouds estimated by cloud cover photographs from satellites. Accordingly, the conclusion is drawn of the existence during convection of a mesoscale structure encompassing the entire boundary layer. This point of view is confirmed by the experimental estimates made of the Rayleigh numbers. Author

N73-31569 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE RESOLUTION OF TELEVISION CAMERAS AND RADIOMETERS ON THE ACCURACY OF CLOUD QUANTITY DETERMINATIONS FROM SATELLITES
O. A. Avaste and G. M. Baynikko *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 43-56 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 36-45 (For availability see N73-31565 22-20)

A study was made of the problems connected with comparing satellite and ground cloud data. It is demonstrated that the most significant factor on which the accuracy of determining the amount of clouds from satellites depends is the resolution of the satellite television cameras or radiometers. The essence of the number of clouds are quite exact only when the area of the resolution element of the receiver is ten times less than the mean cloud element. It is demonstrated that it is possible to construct graphs more precisely to define the estimates of the number of clouds from satellites with the given resolution beginning with probability theory. Author

N73-31570 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF RADAR STUDIES OF THE EVOLUTION OF CONVECTIVE CLOUDS
G. S. Voronov *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 57-68 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 46-55 (For availability see N73-31565 22-20)

The variations of the mesoscale characteristics and basic parameters of convective clouds in time and space are presented. A study is made of the problems of the cyclicity of the development of large-drop centers in cumulonimbus clouds, the effect of the vertical wind shift on size and area of hail storms, the lead time for the introduction of the ice-forming aerosol, and the procedure for artificial modification of cumulonimbus hail clouds to prevent hail from falling in the protected area. Author

N73-31571 Joint Publications Research Service, Arlington, Va.
UTILIZATION OF THE METHOD OF INVERSE SCATTERING TO MEASURE THE TRANSPARENCY OF THE ATMOSPHERE IN THE SLANT DIRECTION c13
Ye. N. Dovgyallo, V. A. Kovalev, and Ye. A. Polyakova *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 69-76 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 56-61 (For availability see N73-31565 22-20)

A study was made of the conditions under which the method of backscattering can be used for working in the slant directions, that is, in a trivially nonuniform atmosphere. It is demonstrated that when executing a defined configuration of the measuring system, the sum of the backscatter signals measured for different positions of the line of sight of the receiver and taken in defined proportions by weight uniquely defines the total transparency of the sounded layer of the atmosphere. The procedure and results of testing the experimental backscatter setup when measuring the transparency in the slant direction are described. Author

N73-31572 Joint Publications Research Service, Arlington, Va.
PROBLEM OF CALCULATING THE THICKNESS OF THE QUASIUNIFORM LAYER OF THE OCEAN c13
I. N. Rusin *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 77-86 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 62-69 (For availability see N73-31565 22-20)

A study was made of the procedure for deriving and finding certain solutions of the equations simulating the annual behavior of thickness of the quasiuniform layer of the ocean. The model is based on laboratory experiments conducted to study the spread of turbulence from the surface into the liquid, and a proposed procedure for constructing the boundary conditions at the lower boundary of the quasihomogeneous layer. It is demonstrated that in spite of the significant number of simplifications, the model obtained gives a qualitatively correct picture of the evolution of the investigated variable. Author

N73-31573 Joint Publications Research Service, Arlington, Va.
DESIGN FOR THE DEVELOPMENT OF MESOMETEOROLOGICAL OBSERVATIONS IN MOSCOW AND IN THE VICINITY OF MOSCOW
V. L. Sklyarov *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 87-93 Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 93-96 (For availability see N73-31565 22-20)

A study was made of the basic principles of the planning of the development and the technical reconstruction of the meteorological network in the territory of Moscow and Moscow Oblast as applied to the problems of mesometeorology. Author

N73-31574 Joint Publications Research Service, Arlington, Va.
PROBLEM OF THE CLOUD ENERGY BALANCE
L. I. Markosova *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 94-99 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 96-99 (For availability see N73-31565 22-20)

On the basis of the results of aircraft measurements of the long-wave radiation fluxes, water content, and temperature in the presence of stratified and stratocumulus clouds, provision is made for the time-space variability of the magnitude of the radiation variation of the temperature and the condensation rate in the clouds. Author

N73-31575 Joint Publications Research Service, Arlington, Va.
FORECASTING THE MEAN MONTHLY AIR TEMPERATURE ANOMALIES FOR OCTOBER IN THE NORTHERN PART OF THE EUROPEAN TERRITORY OF THE USSR
N. A. Aniskina and N. P. Koroleva *In its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 100-107 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 100-104 (For availability see N73-31565 22-20)

A study was made of a method of forecasting the air temperature anomalies on the basis of considering their asynchronous probability relation to the air pressure anomalies in the northern hemisphere (1900 to 1965). The solution is presented in the form of a correlation graph. On the basis of the graph evaluation of the forecasts for 1966 to 1971, conclusions are drawn regarding the efficiency of the proposed procedure. Author

N73-31576# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY, JULY 1973 Key to Meteorological Records Documentation No. 54
Jul. 1973 98 p refs

Avail: NTIS HC $7.00

Cloud data obtained by the National Oceanic and Atmospheric Administration's (NOAA) operational environmental satellites for July 1973 are presented. Daily global satellite imagery of the Northern and Southern Hemispheres is given as a guide for selecting climatological data stored in the NOAA archive. NOAA 2, the third successful satellite of the improved TIROS Operational Satellite (ITOS) system, was placed in a circular, sun-synchronous near-polar orbit for climatological data acquisition. Hemispheric mosaics are reproduced by a computer from infrared and visible data swaths. K.M.M.

N73-31577*# Texas A&M Univ., College Station.
A COMPILATION OF STUDIES FROM ATMOSPHERIC VARIABILITY EXPERIMENT (AVE)
J. R. Scoggins, H. E. Fuelberg, R. D. Carlson, R. W. Phelps, and D. G. Bellue Washington NASA Aug. 1973 198 p refs
(Contract NAS8-26751)
(NASA-CR-2304) Avail: NTIS HC $5.25 CSCL 04A

Five methods for obtaining the sign of vertical motion at various levels in the atmosphere were investigated to determine which gave the best explanation for areas of rain and no-rain in the southeastern United States during the period February 19-22, 1964. The methods used were the terrain-induced vertical motion, the kinematic method including the terrain effect, the adiabatic method, the omega equation, and the vorticity equation combined with Dines' Compensation Principle. Stability and moisture availability were considered but not as extensively as vertical motion. Values of vertical motion obtained by the kinetic method, including orographic lifting produced the best agreement with the observed areas. When terms in the omega equation were added through use of constant multipliers, results comparable to the adiabatic method were obtained. Without this addition large uncertainties occurred. Maps showing areas where terms of the omega equation would indicate positive vertical motion did not correlate well with the observed rainfall patterns. Author

N73-31578# Utrecht State Univ. (Netherlands).
APPLICATIONS OF TURBULENCE MEASUREMENTS OVER LAKE FLEVO Ph.D. Thesis
Johannes Wieringa 28 Jun. 1973 94 p refs
Avail: NTIS HC $6.75

Trivane measured fluctuations are reported of wind and temperature over an inland lake. The analysis includes: (1) tilt errors and precipitation effects in trivane measurements of turbulent fluxes over open water, (2) gust factors over open water and over built up country, and (3) comparison of three methods for determining wind stress over a lake. Author

N73-31579# Weapons Research Establishment, Salisbury (Australia).
MEASUREMENTS OF THE BASIC ATMOSPHERIC PARAMETERS AT WOOMERA USING THE FALLING SPHERE, 1971
S. G. Johnson Feb. 1973 77 p refs
(WRE-TN-786(WR/D)) Avail: NTIS HC $6.00

During 1971, the falling sphere experiment was continued by the Weapons Research Establishment with the dusk-firings of a number of rockets at Woomera, South Australia. A number of profiles of the basic atmospheric parameters were produced. A study of the bias errors associated with the data reduction technique has indicated that the seasonal variations in density, temperature and pressure of the mesosphere are not as large as was previously thought. Revised values of those measurements made in 1970 are presented. Author

N73-31580# Secretariat General a l'Aviation Civile, Paris (France).
ON THE MAXIMUM ANNUAL TEMPERATURES OF PARIS [SUR LES TEMPERATURES MAXIMALES ANNUELLES A PARIS]
R. Arlery Jun. 1973 24 p refs In FRENCH
(MN-Mono-90) Avail: NTIS HC $3.25

A statistical analysis was made of annual maximum temperatures in Paris over a one-hundred year period. A comparison was made with observations of Montsouris and Saint-Maur. Transl. by E.H.W.

N73-31581*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRBORNE MEASUREMENTS OF AIR POLLUTION CHEMISTRY AND TRANSPORT. 1: INITIAL SURVEY OF MAJOR AIR BASINS IN CALIFORNIA
H. R. Gloria, J. N. Pitts, Jr., J. V. Behar, G. A. Bradburn, R. F. Reinisch, and L. Zafonte 30 Sep. 1972 41 p refs Prepared in cooperation with Calif. Univ., Riverside
(Grant NGR-05-008-029)
(NASA-TM-X-69504; SAPRC-1) Avail: NTIS HC $4.25 CSCL 13B

An instrumented aircraft has been used to study photochemical air pollution in the State of California. Simultaneous measurements of the most important chemical constituents (ozone, total oxidant, hydrocarbons, and nitrogen oxides, as well as several meteorological variables) were made. State-of-the-art measurement techniques and sampling procedures are discussed. Data from flights over the South Coast Air Basin, the San Francisco Bay Area, the San Joaquin Valley, the Santa Clara and Salinas Valleys, and the Pacific Ocean within 200 miles of the California coast are presented. Pollutants were found to be concentrated in distant layers up to at least 18,000 feet. In many of these layers, the pollutant concentrations were much higher than at ground level. These findings bring into serious question the validity of the present practice of depending solely on data from ground-based monitoring stations for predictive models. Author

N73-31582*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
SIMULATION STUDIES AND THE DESIGN OF THE FIRST GARP GLOBAL EXPERIMENT
R. Jastrow and M. Halem [1972] 29 p refs
(NASA-TM-X-69613) Avail: NTIS HC $3.50 CSCL 04B

Simulation studies have played an increasingly important role in planning for the First GARP Global Experiment (FGGE) during the last two years by providing information on the meteorological impact of various untested or incompletely tested elements of the GARP observing system. The studies are intended to provide information to FGGE planners on the capabilities of alternature systems for meeting a specific FGGE requirement. The simulation studies also provide a valuable input to cost-effectiveness studies by indicating tradeoffs of one possible type of observing platform against another, such as constant-level balloons vs buoys. These tradeoffs can lead to major gains in research yield per dollar of expenditure on the observing system. Author

N73-31583# Argonne National Lab., Ill. Center for Environmental Studies.
METHODOLOGY FOR CONTROLLING AIR POLLUTION EPISODES
T. D. Wolsko, M. T. Matthies, and R. F. King Sep. 1972 209 p refs
(Contract W-31-109-eng-38; EPA-IAG-0025(R))
(ANL/ES-14) Avail: NTIS HC $3.00

A methodology for developing effective, preplanned emission control strategies for urban pollution episodes is presented. A steady-state Gaussian dispersion model is applied to known emission inventories for various sets of meteorological conditions that are liable to exist during episodes. Calculated pollution contours are plotted directly on 35 mm film for projection onto a larger display format that is convenient for identifying episode problems and planning control strategies. The procedures are applicable to nonreacting, airborne pollutants. Author

N73-31584# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
RESEARCH WORK OF THE DFVLR IN THE FIELD OF ENVIRONMENTAL PROTECTION. PART 1: AIR CLEANLINESS
D. Paffrath 30 May 1972 93 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-72-14-Pt-1) Avail: NTIS HC $6.75; DFVLR, Porz, West Ger. 23,80 DM

Topics in the field of air pollution and the remonitoring are dealt with. The emissions of air breathing engines were investigated, and measures are proposed to reduce these in, for example, the engine components, the fuels, and the combustion

chambers. Possibilities of air pollution sensing from aircraft and satellite are reviewed. Problems of emmissions in the atmosphere are discussed. The propagation of air pollutants through the atmosphere, as determined by meteorological and boundary layer parameters, is surveyed. ESRO

N73-31585# Army Electronics Command, Fort Monmouth, N.J.
AN INTEGRATED ERROR DESCRIPTION OF ACTIVE AND PASSIVE BALLOON TRACKING SYSTEMS
Walter B. Miller and Donald R. Veazey Jun. 1973 33 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-763890; ECOM-5500) Avail: NTIS CSCL 04/2

The primary objective of this presentation is to describe the integrated error behavior of a passive tracking system; in particular, the rawinsonde. Certain intrinsic error characteristics of active and passive balloon tracking systems are presented, with consideration given to possible weaknesses of the latter system for many objectives in mesocale variability. Error surfaces are described for vertically consistent fundamental error parameters, and it emerges that the active system has considerable advantages. It is shown that there exist certain objective considerations arising from intrinsic error properties, and which relate to problems of use and placement of passive or active systems. These objective properties should prove of value in determining optimal configurations. The material is essentially descriptive, and is intended to provide a basic framework through which observed characteristics may be explained and additional features predicted. (Modified author abstract) GRA

N73-31586# Missouri Univ., Rolla. Dept. of Physics.
CURRENT METEOROLOGICAL THEORY OF THE CONDENSATIONAL GROWTH OF A STATIONARY DROP
John C. Carstens 1973 50 p refs
(Grant DA-ARO(D)-31-124-72-G188; DA Proj. 200-61102-B-53B)
(AD-764258; AROD-10661-1-EN) Avail: NTIS CSCL 04/2

The purpose of this report is to elaborate a specific theory of drop growth by condensation for use in cloud physics and various laboratory calculations related to cloud physics. It has been assimilated, for the most part, from existing literature, but in no one place has it received full exposition. This work therefore claims neither comprehensiveness, in treating all aspects and theories of drop growth, nor profundity in revealing new facets of the phenomena. Author (GRA)

N73-31587# Meteorology International, Inc., Monterey, Calif.
THE DEVELOPMENT OF TECHNIQUES FOR OPERATIONAL EXPLOITATION OF SATELLITE INFRARED CHANNEL RADIANCES IN THE RESOLUTION OF ATMOSPHERIC THERMAL-STRUCTURE VARIABILITIES. TASK ONE: PERSPECTIVE
Manfred M. Holl Sep. 1972 68 p refs
(Contract N62306-72-C-0125)
(AD-764296) Avail: NTIS CSCL 04/2

The report discusses the development of techniques for operational exploitation of satellite infrared channel radiances in the resolution of atmospheric thermal-structure variabilities. Of primary interest are satellite measurements in radiance channels selected in strongly absorbing bands of a gas of uniform air mixing ratio (e.g., the 15-micron band of band of Carbon Dioxide). Sensor systems of this type include (SIRS) Satellite Infrared Spectrometer, (ITPR) Infrared Temperature Profile (SIRS) Satellite Infrared Spectrometer, (ITPR) Infrared Temperature Profile Radiometer, (VTPR) Vertical Temperature Profile Radiometer, and (IRIS) Infrared Interferometer Spectrometer. GRA

N73-31588# Naval Postgraduate School, Monterey, Calif.
STABILITY OF A TROPICAL MODEL INCLUDING SHEAR, SURFACE FRICTION AND CISK HEATING M.S. Thesis
Terry G. Robertson Mar. 1973 57 p refs
(AD-764090) Avail: NTIS CSCL 04/2

The structure of barotropically unstable disturbances in the tropics is studied with a two-level quasi-geostrophic model. An Ekman layer is attached to the lower boundary. The equations are linearized and the most unstable mode is found numerically by use of the initial value technique. CISK heating, horizontal friction and shear are introduced to give more realistic solutions. Computations are made for two shear zone wind profiles. (Modified author abstract) GRA

N73-31589# Battelle Columbus Labs., Ohio.
CHEMICAL AND PHYSICAL CHARACTERIZATION OF AUTOMOTIVE EXHAUST PARTICULATE MATTER IN THE ATMOSPHERE Final Summary Report, 25 Jun. 1971 - 30 Jun. 1972
C. W. Melton, R. I. Mitchell, D. A. Trayser, and J. F. Foster 14 Jun. 1973 91 p
(Contract EPA-68-02-0205)
(PB-221603/4; CRC-APRAC-CAPE-19-70-2) Avail: NTIS HC $3.00 CSCL 13B

The report describes a third year of studies directed toward determining the fate of auto exhaust particles in the atmosphere. Experimental apparatus and procedures have been developed, and analytical data have been accumulated on particle characteristics and morphology. In the year covered by this report, preparation, instrumentation and deposit conditioning of two automobiles has been completed in preparation for systematic examination of particulate emissions during the coming year. Environmental variables are to be studied for influences on the properties and fate of aerosols emitted by the automobiles and diluted by mixing with the ambient atmosphere. This report is presented in two major sections describing first the experimental apparatus and procedures, and then the experimental results with discussion of their significance and interpretation. GRA

N73-31590# Wisconsin Univ., Madison. Water Resources Center.
CIRCULATION PATTERNS IN LAKE SUPERIOR
John A. Hoopes, Robert A. Ragotzkie, San-Lang Lien, and Ned P. Smith Apr. 1973 83 p refs
(Contract DI-14-01-0001-1057)
(PB-220244/8; WIS-WRC-73-04W73-09106; OWRR-B-009-WIS(5)) Avail: NTIS HC $3.00 CSCL 04B

Lake circulation studies were directed toward Lake Superior for the purpose of broadening the quantitative understanding of large-scale circulation patterns induced by wind and atmospheric pressure variations over lakes under homogeneous and stratified conditions. One phase considers the numerical and physical modelling of lake circulation under uniform density conditions. The effects of lake geometry and wind stress distributions on the movement of water are considered. Coriolis forces were considered in the models. The second phase involves the analysis and interpretation of field observations of currents and temperatures for the central region of Lake Superior, between the Keweenaw Peninsula and Isle Royale during seasons when lake stratification conditions predominate. Bathythermography data and airborne infrared surface temperature surveys were collected at the same time to permit the investigators to make inferences about the temperature structure of the interior of the lake, given only the surface temperature pattern. (Author Modified Abstract) GRA

N73-31591# Montana State Univ., Bozeman. Water Resources Research Center.
RESEARCH IN THE DEVELOPMENT AND UTILIZATION OF ATMOSPHERIC WATER RESOURCES IN MONTANA Completion Report, 1 Jul. 1972 - 30 Jul. 1973
Robert H. Yaw 30 Jun. 1973 55 p
(Contract DI-14-31-0001-3826)
(PB-222004/4; OWRR-A-062-MONT(1); Rept-37W73-11712) Avail: NTIS HC $3.00 CSCL 04B

In the spring of 1972, intense activity was in progress in several western states to develop and use weather modification techniques to increase growing season precipitation. In Montana, lack of public knowledge and awareness, in combination with a state law which inhibited cooperative research, was minimizing opportunities for the accumulation of factual knowledge of potential value to residents of the state. A research and information program resulted in a greatly increased awareness of weather modification and the need for research in Montana, changes to the state weather modification law, the availability of $100,000.00 for a cooperative state-federal research program, and awareness in the Montana Congressional Delegation of local interests and desires. (Modified author abstract) GRA

N73-31592# Transport and Road Research Lab., Crowthorne (England).
THE CONCENTRATION OF VOLATILE AND PARTICULATE LEAD COMPOUNDS IN THE ATMOSPHERE: MEASURES AT FOUR ROAD SITES
D. M. Colwill and A. J. Hickman 1973 8 p refs
(PB-221663/8; TRRL-LR-545) Avail: NTIS HC $3.00 CSCL 13B

Total lead pollution in the atmosphere has been measured at four sites, two at fuel stations on heavily trafficked roads, one in an urban road tunnel and one on a busy rural motorway. The values for both the particulate and the volatile lead compounds are reported. The contribution of the volatile materials to the total lead pollution has been found to be significant, comprising approximately 55 and 30 per cent of the approximately 2 micrograms/cu meters total at the filling stations and approximately 10 per cent of the 15 micrograms/cu meters and 10 micrograms/cu meters average totals at the tunnel and the motorway respectively. Considerable variations were found in the data obtained at the tunnel and the motorway site. (Modified author abstract) GRA

N73-31593# Naval Intelligence Support Center, Washington, D.C. Translation Div.
THE FIRST STAGE OF A SYSTEM FOR LARGE-SCALE AUTOMATION OF THE HYDROMETEOROLOGICAL SERVICE OF THE USSR
G. M. Vaisman 11 Jul. 1973 20 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 5, 1970 p 94-101
(AD-763956; NISC-Trans-3449) Avail: NTIS CSCL 04/2

The main trends of the first experimental stage for technical reequipping of the Hydrometeorological Service of the USSR, carried out by the Administration of the Hydrometeorological Service of the Belorussian SSR, are outlined. Some results of practical application of new methods and technical facilities for automation of observations, collection and processing of various types of hydrometeorological data are presented. Author (GRA)

N73-31594# Argonne National Lab., Ill. Center for Environmental Studies.
AN AIR POLLUTION IMPACT METHODOLOGY FOR AIRPORTS, PHASE 1 Final Report
J. E. Norco, R. R. Cirillo, T. E. Baldwin, and J. W. Gudenas Jan. 1973 309 p refs
(Contract EPA-IAG-0171(D))
(PB-220987/2; ANL/ES-22; APTD-7470) Avail: NTIS HC $9.00 CSCL 13B

It has been demonstrated that large airports have a direct impact on environmental quality as a result of aircraft operation and an indirect impact by providing a focal point for urban development and industrialization. This report addresses the air pollution impact of an airport and its environs. A methodology is presented for integrating the air pollution impact of an airport and its associated ground-support activities with that of the induced urban development in its vicinity, to provide a quantitative basis for decisions related to airport site selection and for the development of land surrounding the site. Procedures for estimating airport-related air pollutant emissions are defined. The flexible impact methodology is achieved through a general protocol for identifying, isolating and quantifying an array of airport related and urban activities which provide environmental insults. The procedures are general and applicable to either existing or proposed airport facilities. It was developed and field tested using data from the proposed St. Louis Airport at Waterloo/Columbia, Illinois, from the Chicago O'Hare International Airport and from several other existing facilities. Author

N73-31595# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
AIR QUALITY DATA HANDLING SYSTEM USERS MANUAL
Nov. 1972 72 p refs
(PB-220985/6; APTD-1086) Avail: NTIS HC $4.50 CSCL 13B

The Air Quality Data Handling System (AQDHS) was developed to aid air pollution control agencies in the handling of their air quality and meteorological data. The AQDHS is intended to be used by state and local air pollution control agencies on their own computer system. The AQDHS Users Manual describes the computer system and its operation. Manual data preparation specifications are discussed in detail. The file creation, storage, and update programs; data analysis program; data report programs; and the National Aerometric Data Bank Input programs are described and their operation detailed. Author (GRA)

N73-31596# Naval Weather Service Environmental Detachment, Asheville, N.C.
GUIDE TO STANDARD WEATHER SUMMARIES AND CLIMATIC SERVICES
Jan. 1973 203 p refs
(PB-221354/4; NAVAIR-50-1C-534) Avail: NTIS HC $3.00 CSCL 04B

The publication provides a description of published and unpublished climatological summaries available from the National Climatic Center. It also includes a catalogue of the available summaries on a world-wide basis in continent-country-station order. GRA

N73-31597# General Research Corp., Santa Barbara, Calif.
IMPACTS OF TRANSPORTATION CONTROL STRATEGIES ON LOS ANGELES AIR QUALITY
J. R. Martinez, R. A. Nordsieck, and A. Q. Eschenroeder May 1973 66 p refs
(Contract EPA-68-02-0336)
(PB-221301/5; GRC-CR-4-273; EPA-R4-73-013-Vol-d) Avail: NTIS HC $5.50 CSCL 13B

A photochemical/diffusion simulation model is employed to evaluate four control strategies for reducing air pollution in Los Angeles. Three previously tested, representative air trajectories serve as baseline cases using 1969 emission levels. Transportation controls are emulated by reducing source emissions in accordance with hypothetical plans worked out with the Division of Meteorology of the Environmental Protection Agency. Straight reductions of vehicle miles traveled do not give ozone reduction percentages that are as large as the emission reduction percentages. Strong influence of initial pollutant load of the air in the morning is noted. Day-to-day pollution carryover must be carefully adjusted through the initial conditions to account for continous strategies in contrast with intermittent strategies. Ratios of nitrogen oxides to reactive hydrocarbon affect the ozone buildup markedly. It is found that control of the mixture ratio can be more important than straight reduction in emissions.
Author (GRA)

N73-31598# TRW Systems Group, Redondo Beach, Calif. Transportation and Environmental Operations.
TRANSPORTATION CONTROL STRATEGY DEVELOPMENT FOR THE GREATER HOUSTON AREA Final Report, 14 Aug. - 15 Dec. 1972
Fred Winkler Dec. 1972 188 p
(Contract EPA-68-02-0041)
(PB-221611/7; APTD-1373) Avail: NTIS HC $11.50 CSCL 13B

The report presents control measures that, if fully implemented, will allow achievement of ambient air quality standards in the Greater Houston Area by 1977. The study was directed toward measures to control photochemical oxidants and carbon monoxide. The measure evaluations include an assessment of their technical effectiveness and institutional/social feasibility.
GRA

N73-31599# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
DESIGN AND CONSTRUCTION OF A SYSTEM FOR REMOTE OPTICAL SENSING OF EMISSIONS
M. L. Streiff and C. L. Claysmith Oct. 1972 446 p
(Contract EPA-CPA-22-69-142)
(PB-221073/0; EPA-R2-72-052) Avail: NTIS HC $6.00 CSCL 13B

The overall and detail instrument design and initial acceptance test performance of a system for remote sensing of emissions are described. The instrument may be used to measure transmission of urban atmospheres, using a remote source or to measure emission from sources such as smokestacks. It is designed to measure the absorption or emission caused by pollution by scanning spectrally in the 3 to 5.5 micron and 7 to

13.5 micron regions. Data may be recorded on a strip chart recorder, a digital printer, and/or a magnetic tape recorder. The various sections of the report provide: a discussion of the system design followed by a description of component details, setup procedures and operation, system performance in the laboratory and results of initial field tests, and maintenance recommendations. Author (GRA)

N73-31600# General Research Corp., Santa Barbara, Calif.
USER'S GUIDE TO DIFFUSION/KINETICS (DIFKIN) CODE, VOLUME B
J. R. Martinez Oct. 1972 66 p refs
(Contract EPA-68-02-0336)
(PB-220243/0; GRC-CR-2-273-Vol-B; EPA-R4-73-012-Vol-B)
Avail: NTIS HC $4.50 CSCL 13B

The manual is intended for users of the GRC Diffusion/Kinetics (DIFKIN) code for simulating photochemical smog. The general structure and operational capabilities of the code are described Detailed instructions for program use are provided to assist prospective users in operating the code. Author (GRA)

N73-31601# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
VARIABILITY OF PLANETARY BOUNDARY LAYER WINDS
Lee Ray Hoxit Mar. 1973 184 p refs
(Grant NSF GA-32589)
(PB-221752/9; CSU-ATSP-199) Avail: NTIS HC $11.25 CSCL 04B

Systematic stratifications and analyses of low level radiosonde and windsonde data are performed for portions of the eastern half of the United States. Changes in the planetary boundary layer wind profiles resulting from variations in baroclinicity, stability and speed are specified. Interpretations and conclusions concerning the physical processes responsible for the observed variations are presented. An empirical model of the height distribution of the ageostrophic wind is developed for the lowest 2.5 km of the atmosphere. (Modified author abstract) GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-31602# Ohio Univ., Athens. Avionics Engineering Center.
SNOW EFFECTS ON IMAGE GLIDE PATH SYSTEMS, WINTER OF 1971-1972 Final Report
Jack B. Morehart, Richard H. McFarland, and David C. Hildebrand Jul. 1972 19 p refs
(Contract DOT-FA69WA-2066)
(FAA-RD-72-85) Avail: NTIS HC $3.00

Results of tests to determine the effect of snow on image glide path systems are presented. Effects on three systems, capture effect, null reference, and sideband reference are discussed in terms of change in the far-field signal characteristics. Data include: (1) far-field signals such as received in the aircraft,(2) conventional near-field monitor signals,(3) analog, integral-monitor signals, and (4) trends of the signals as a function of environmental condition. The primary conclusions are that new snow depths less than eight inches do not generally cause a change in the path but a change in the snow surface condition such as during a thaw tends to make the path move upward as if the ground plane were simply elevated. The conclusions agree with theoretical predictions. Author

N73-31603# Federal Aviation Administration, Washington, D.C.
EVALUATION OF A TERRAIN PROXIMITY WARNING SYSTEM (DOWNWARD LOOKING RADAR) FOR POSSIBLE ENHANCEMENT OF FLIGHT SAFETY Interim Report, Mar. - May 1973
Jack J. Shrager Aug. 1973 26 p refs
(FAA Proj. 076-311-000)
(FAA-RD-73-134) Avail: NTIS HC $3.50

A review of all literature and available test results of an airborne independent altitude monitor based on radio altitude information was undertaken. Results indicated that limited flight safety enhancement is attainable by use of such a device. Author

N73-31604*# Applied Information Industries, Moorestown, N.J.
STUDY OF PRECISE POSITIONING AT L-BAND USING COMMUNICATIONS SATELLITES Final Report
27 Oct. 1971 150 p
(Contract NAS6-1962)
(NASA-CR-62095) Avail: NTIS HC $9.50 CSCL 17G

The L-band positioning experiment is reported which encompassed experiment design, experimentation, and data reduction and analysis. In the experiment the ATS-5 synchronous satellite L-band transponder was used in conjunction with the modified ALPHA 2 navigation receivers to demonstrate the technical capability of precision position fixing for oceanographic purposes. The feasibility of using relative ranging techniques implemented by two identical recieving systems, properly calibrated, to determine a line of position accurately on the surface of the earth was shown. The program demonstrated the level of resolution, repeatibility, precision, and accuracy of existing modest-cost effective navigation equipment. The experiment configuration and data reduction techniques were developed in parallel with the hardware modification tasks. Test results verify the ability of a satellite-based system to satisfy the requirements of precision position fixing. Author

N73-31605# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THE 1972 LOS ANGELES BASIN STANDARD AIR TRAFFIC MODEL Final Report
Francis M. Willett, Jr. Sep. 1973 53 p refs
(FAA Proj. 013-601-010)
(FAA-NA-73-51; FAA-RD-73-90) Avail: NTIS HC $4.75

The methodology used in the construction of a three dimensional aircraft movement operating in the Los Angeles Basin area is described. From data obtained, the Los Angeles Basin air traffic model of 1972 was constructed. The model contains approximately 80-percent VFR flight operations, and represents a particular time period of nonpeak operations which occurred during a 3 hour period on 20 August 1972. The purpose of the traffic sample is to develop a standard model to test future air traffic systems and equipment. Since most air traffic operation models are generally made from IFR-controlled operations, this is the first of a series of air traffic models that include both IFR and VFR operations. Author

N73-31606# Meta Systems, Inc., Santa Clara, Calif.
POTENTIAL CONFLICT PREDICTION AND ASSOCIATED FUNCTIONS FOR OCEANIC AIR TRAFFIC CONTROL AUTOMATION Final Report, Mar. 1972 - May 1973
Frank V. Giallanza, Charles P. Giallanza, and James C. Brown May 1973 56 p
(Contract DOT-FA72WA-2851)
(FAA-RD-73-73) Avail: NTIS HC $5.00

Algorithms to determine potential conflicts over an oceanic airspace based on given vertical, lateral, and longitudinal separation criteria were developed. Additional algorithms to handle special cases have yet to be developed. Associated functions used by air traffic controllers to resolve conflict situations are also described. Author

N73-31607# System Development Corp., Santa Monica, Calif.
SOUTHERN CALIFORNIA REGIONAL AVIATION SYSTEM STUDY Summary Report
1972 23 p Presented to the SCAG Airport Study Authority, Los Angeles, 19 July 1972 Supplement to the Final Report and Final Technical Document Sponsored in part by FAA and HUD Prepared jointly by the System Develop. Corp. and by Pereira (William L.) Associates for the Southern Calif. Assoc. of Govt. Aviation Study Authority
Avail: NTIS HC $3.25

A study of the Southern California regional aviation system was conducted. The study was aimed at delineating the broad areas and linkages that reveal the interactions between the air transportation system and the life styles, socioeconomic structure,

and total environment. One objective was to provide broad planning guidance in the development of plans, policies, standards, and strategies for the future of aviation on a national wide basis. The study indicates the need for a national system of global airports to cope with future requirements. Author

N73-31608*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SIRU DEVELOPMENT. VOLUME 2: GYRO MODULE Final Report
Roscoe Cooper and Thomas Shuck Jun. 1973 73 p
(Contract NAS9-8242; MIT Proj. 55-32600)
(NASA-CR-135509; R-746-Vol-2) Avail: NTIS HC $5.75 CSCL 17G

The design, operation, performance and test of the gyro module and its circuit components are described for the Strapdown Inertial Reference Unit system. Author

N73-31609*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
STRAPDOWN SYSTEM PERFORMANCE OPTIMIZATION TEST EVALUATIONS (SPOT), VOLUME 1 Final Report
Richard J. Blaha and Jerold P. Gilmore Feb. 1973 235 p refs
(Contract NAS9-6823; DSR Proj. 55-29435)
(NASA-CR-135484; R-743-Vol-1) Avail: NTIS HC $13.75 CSCL 17G

A three axis inertial system was packaged in an Apollo gimbal fixture for fine grain evaluation of strapdown system performance in dynamic environments. These evaluations have provided information to assess the effectiveness of real-time compensation techniques and to study system performance tradeoffs to factors such as quantization and iteration rate. The strapdown performance and tradeoff studies conducted include: (1) Compensation models and techniques for the inertial instrument first-order error terms were developed and compensation effectivity was demonstrated in four basic environments; single and multi-axis slew, and single and multi-axis oscillatory. (2) The theoretical coning bandwidth for the first-order quaternion algorithm expansion was verified. (3) Gyro loop quantization was identified to affect proportionally the system attitude uncertainty. (4) Land navigation evaluations identified the requirement for accurate initialization alignment in order to pursue fine grain navigation evaluations. Author

N73-31610# Engins Matra, Velizy (France).
STAR MAPPER, SECOND PHASE [STAR MAPPER, DEUXIEME PHASE]
J. V. Vaugien, J. Brillaud, and M. Germain Paris ESRO Mar. 1973 166 p In FRENCH; ENGLISH summary
(Contract ESTEC-1107/70)
(ESRO-CR-82) Avail: NTIS HC $10.50

The design of a star mapper employing a solid state detector is dealt with. The design is based on the results of the first phase of the contract, and is concerned with the optics and associated electronics. Two alternatives for the optics are considered: one with a dioptric objective and the other with a combined objective and mirror. For the electronics, the principle of the on-board data handling and an evaluation of the mass and power consumption are given. The second point dealt with is the development of algorithms for the recognition of star patterns. The data on which the recognition of such patterns is based are the following: the positions of two or three stars and the solar aspect angle. The complete set of programs for the calculation is given, together with the program enabling data to be generated for testing the recognition algorithms.
Author (ESRO)

N73-31611# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).
DESIGN AND DEVELOPMENT OF A STARMAPPER BREADBOARD MODEL
A. Hammerschlag, C. W. Deboom, C. Smorenburg, H. Vanooijen, J. D. VanZijverden, P. J. Oprel, and T. J. Burrett Paris ESRO Mar. 1973 245 p refs
(Contract ESTEC-1503/71)
(ESRO-CR-162) Avail: NTIS HC $14.25

A conceptural design study was made on the sensor for a star mapper system permitting the reconstitution of the attitude of a spinning spacecraft from star coordinates. Star passage sensors can use either photomultipliers or Si photodiodes. The performace limits of both types were investigated. The photomultiplier version is sensitive and requires only a small optical system. The Si-photodiode version is more rugged and reliable and can be made much less sensitive to spurious inputs; its performance is mainly limited by electronic noise. On the basis of data from a separate Si-detector evaluation study and a theoretical analysis of the signal-conditioning electronics, formulae were developed for the prediction of the S/N ratio for various configurations. The recommended configuration is one in which the slit pattern is defined in the detector's sensitive area. Such a design makes possible a spin axis determination of + or - 1 accuracy with an 80 mm diameter optical system at 10 rpm. Accuracy falls off linearly with spin rate. Within the constraints that this choice entails, a large amount of redundancy and versality of operation can be incorporated at a small sacrifice of weight and power.
Author (ESRO)

N73-31612# Army Foreign Science and Technology Center, Charlottesville, Va.
APPLICATION OF THE LUCH RADIO DISTANCE FINDER
Yu. V. Vorooev 7 Mar. 1973 13 p refs Transl. into ENGLISH from Geod. i Kartografiya (USSR), no. 9, 1971 p 24-31
(AD-763416; FSTC-HT-23-1262-72) Avail: NTIS CSCL 17/7

Pilot-plant tests of the Luch radio distance finder built in 1969 were successful and in 1970 the distance finder was already in use on the field. The operating qualities of the radio distance finder were more fully revealed under field conditions. In 1970 radio distance finder measurements were made in the Transpolar tundra. Before field work was begun, radio distance measuring stations were comprehensively checked under laboratory conditions; meteorological instruments were standardized; auxiliary equipment was checked. During field operations, scale frequencies were verified (and reduced to the rated values) every two months. A reference standard generator was used to monitor frequencies. GRA

N73-31613# Naval Postgraduate School, Monterey, Calif.
RADIO DIRECTION FINDING FIX SOLUTION IN SPHERICAL TRIGONOMETRY WITH CONFIDENCE REGION AND LOCATION ERROR ANALYSIS M.S. Thesis
Ronald Lee Potts Mar. 1973 112 p refs
(AD-764465) Avail: NTIS CSCL 17/7

Although parts of the paper may be applicable to various other location finding systems, radio direction finding was selected for development because of the extensive literature available on the subject. Using a modification of the navigation coordinate system, equations in spherical trigonometry are developed by analogy with graphical solution procedures. Ellipticity of the earth is corrected for by use of geocentric latitude in all calculations. The least squares solution is found by a combination of second-order gradient searches and Golden Section Searches on the corrected sphere. A Chi-Square contour confidence region is presented with defense against the empty region arguments and with verification of its reliability of target containment. Sensitivity of location error to network layout, number of measurements available and intercept geometry factors is examined by computer simulation, demonstrating the predictive value of these statistics. (Modified author abstract) GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-31614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IRRADIATION OF THREE T-111 CLAD URANIUM NITRIDE FUEL PINS FOR 8070 HOURS AT 990 C (1815 F)
Jack G. Slaby, Byron L. Siegel, Louis Gedeon, and Robert J. Galbo Washington Oct. 1973 39 p refs

(NASA-TM-X-2878; E-7474) Avail: NTIS HC $3.00 CSCL 18J

The design and successful operation of three tantalum alloy (Ta-8W-2Hf) clad uranium mononitride (UN) fuel pins irradiated for 8070 hr at 990 C (1815 F) is described. Two pin diameters having measured burnups of 0.47 and 0.90 uranium atom percent were tested. No clad failures or swelling was detected; however, postirradiation clad samples tested failed with 1 percent strain. The fuel density decrease was 2 percent, and the fission gas release was less than 0.05 percent. Isotropic fuel swelling, which averaged about 0.5 percent, was less than fuel pin assembly clearances. Thus the clad was not strained. Thermocouples with a modified hot zone operated at average temperatures to 1100 C (2012 F) without failure. Factors that influence the ability to maintain uniform clad temperature as well as the results of the heat transfer calculations are discussed. Author

N73-31615# Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik.

DEVELOPMENT OF CALCULATION METHODS AND CODES AND THEIR APPLICATION TO SPACE REACTOR SHIELDING

E. Amin, G. Hehn, W. Klumpp, and R. Ruehle 1972 11 p refs Presented at the 4th Intern. Conf. on Reactor Shielding, Paris, 9 Oct. 1972

(Conf-721018-22) Avail: AEC Depository Libraries $3.00

The modular program RSYST was developed to simplify the handling of various reactor and shielding problems with large data inputs and outputs. The system operates with a central data pool from which the individual modules receive data and results. A special S sub N procedure is recommended for deep two-dimensional penetration problems. This procedure, which utilizes the local separation technique overcomes the ray effect by applying the first collision correction. An optimization method using dynamic programming was developed for space reactor shielding. Author (NSA)

N73-31616# Los Alamos Scientific Lab., N.Mex.

THERMODYNAMIC ANALYSIS OF MHW SPACE ELECTRIC POWER GENERATOR

R. A. Kent Mar. 1973 108 p refs

(Contract W-7405-eng-36)

(LA-5202-MS) Avail: NTIS HC $3.00

A thermodynamic analysis was made for the proposed multihundred watt isotopic electric power heat source for space missions. The heat source consists of plutonium dioxide fuel spheres encapsulated in welded iridium shells that in turn are surrounded by graphite ablation shields. Published data for the component systems Pu-O, Pu-Ir, Pu-C, Ir-O, and Ir-C were reviewed and employed to calculate the thermochemical behavior during mission lifetime. Author (NSA)

N73-31617# AEG-Telefunken, Frankfurt (West Germany). Fachgebiet Leistungsreaktoren.

FISSION CHAMBER DETECTOR DRIVE SYSTEM [ANTRIEBSSYSTEM FUER SPALTKAMMERN]

M. Stimler Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Dec. 1972 24 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-K-72-25) Avail: NTIS HC $3.25, Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 3,20 DM

Details of the manufactured prototype in-core, out-core detector drive system for application to a boiling water reactor are presented. This drive brings the source range detectors and the intermediate range detectors for the measurement of neutron flux into a fixed position in the core before starting up. After the reactor has reached the power range, the drive transports the detectors out of the core again. Details are given of the drive system, the control system, and the long time tests of both systems. Results applicable to the serial manufacturing of the drive are given. ESRO

N73-31618# AEG-Telefunken, Frankfurt (West Germany). Fachgebiet Leistungsreaktoren.

MOBILE CHAMBER SYSTEM FOR CALIBRATION OF FIXED INCORE PROBES

M. Stimler Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Dec. 1972 42 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-K-72-26) Avail: NTIS HC $4.25; Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 6,50 DM

The construction and manufacture of a prototype mobile chamber for calibration of fixed incore detectors and its control system are detailed. The objective of this program is to develop a system for serial manufacture which makes it possible to calibrate the fixed fission chambers distributed in the core for power measurement, dosing their sensitivity by burnup. The calibration should take place automatically. Results of tests are reported, and serial manufacturing implications are reviewed. (ESRO)

N73-31619# Internationale Atomreaktorbau Gesellschaft, Bensberg (West Germany).

DEVELOPMENT OF IDA, AND INTEGRATED HEAT EXCHANGER/STEAM GENERATOR FOR SODIUM-COOLED FAST BREEDER REACTORS Final Report

P. Albus, K. Dumm, K. Foerster, R. Gerstler, G. Hahn, E. teHeesen, J. Keusenhoff, W. Meineke, B. Schellong, and E. Zipper Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Dec. 1972 76 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-K-72-28) Avail: NTIS HC $6.00; Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 13,65 DM

In order to eliminate the intermediate system normally used for sodium cooled power reactors, a reaction proof steam generator with a triple wall tube (steel-copper steel) as a heat exchanging element has been developed. Technical and metallurgical investigations were carried out with regard to the operation and failure characteristics of the triple wall tube. The test of a MW prototype steam generator, as well as the thermodynamic and functional studies of a nuclear power station with the same safety requirements as the SNR-300 reference reactor, were satisfactory. ESRO

N73-31620# Army Engineer Waterways Experiment Station, Livermore, Calif. Explosive Excavation Research Lab.

THERMAL AND REACTOR ANALYSIS OF NUCLEAR ROCKET TRANSIENTS Ph.D. Thesis - N. C. State Univ., Raleigh

Robert R. Mills, Jr. Mar. 1973 217 p refs

(AD-764231; EERL-MP-E-73-2) Avail: NTIS CSCL 21/6

The thermal and nucleonic behavior of a nuclear rocket during the startup transient was investigated. The fluid flow and heat transfer of the hydrogen coolant was thoroughly analyzed. It was found that the ideal gas law produced reasonably accurate results over the range of temperatures and pressures used in this study. A one-dimensional time-independent form of the three-dimensional time-dependent fluid flow equations was developed and shown to be suitable for calculations over a very wide range of fluid temperature and pressure. An expression for heat transfer in the fuel-moderator was derived which simplified time-dependent calculations of average fuel temperature distributions and wall temperature distributions. A three-group model of the reactor physics provided a good understanding of the neutronics of a NERVA reactor. (Modified author abstract) GRA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-31621 Washington Univ., St. Louis, Mo.

THE THEORY OF THE GRATING COUPLER Ph.D. Thesis

Kinichiro Ogawa 1972 244 p

Avail: Univ. Microfilms Order No. 73-11823

A theoretical analysis of the grating coupler for application in thin film integrated optical waveguides is presented. The problem is formulated in terms of the perturbation produced on the surface modes and the continuous mode of a uniform

waveguide by a periodic variation in the refractive index of the film. The input coupling efficiency for plane wave illumination from either the air or the substrate sides of the waveguide is calculated as well as the optimum coupling length. The propagation constant of the surface mode due to the radiation loss is also given in terms of leaky wave. The radiation pattern for the output coupler application of the grating structure is also given. The general behavior of the grating couplers, their relations to prism couplers, and the physical principles involved in their operation are explored. Detailed design curves are given for three grating structures. Dissert. Abstr.

N73-31622 Johns Hopkins Univ., Baltimore, Md.
DETECTION OF WEAK OPTICAL IMAGES WITH PHOTON COUNTING TECHNIQUES Ph.D. Thesis
John Joseph Amoss 1972 136 p
Avail: Univ. Microfilms Order No. 73-12111

A new technique has been developed and implemented to record very weak images with the use of photon counting methods. The system constructed utilizes a flexible fiber optic probe to scan the image. The probe directs the optical field to a photomultiplier which is used as the detecting element. Output pulses of the photomultiplier are used to obtain an estimate of the average intensity at an image point. This estimate is obtained with the use of a minicomputer which records and processes the pulses in real time. It is shown that in the cases studied, both the time to the arrival of the Mth output pulse (M = 1,2,3,...), and also the number of output pulses, n, in a sample interval, T, are sufficient statistics and both of these statistics are utilized to obtain MAP estimates of the average field intensity. Dissert. Abstr.

N73-31623*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN IMPROVED METHOD FOR DESIGN OF EXPANSION-CHAMBER MUFFLERS WITH APPLICATION TO AN OPERATIONAL HELICOPTER
Tony L. Parrott Washington Oct. 1973 73 p refs
(NASA-TN-D-7309; L-8888) Avail: NTIS HC $3.50 CSCL 20A

An improved method for the design of expansion-chamber mufflers is described and applied to the task of reducing exhaust noise generated by a helicopter. The method is an improvement of standard transmission-line theory in that it accounts for the effect of the mean exhaust-gas flow on the acoustic-transmission properties of a muffler system, including the termination boundary condition. The method has been computerized, and the computer program includes an optimization procedure that adjusts muffler component lengths to achieve a minimum specified desired transmission loss over a specified frequency range. A printout of the program is included together with a user-oriented description. Author

N73-31624*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN PARAMETERS OF TOROIDAL AND BOBBIN MAGNETICS
W. T. McLyman 15 Sep. 1973 139 p refs
(Contract NAS7-100)
(NASA-CR-133932; JPL-TM-33-651) Avail: NTIS HC $9.00 CSCL 20C

The adoption by NASA of the metric system for dimensioning to replace the long-used English units imposes a requirement on the U.S. transformer designer to convert from the familiar units to the less familiar metric equivalents. Material is presented to assist in that transition in the field of transformer design and fabrication. The conversion data makes it possible for the designer to obtain a fast and close approximation of significant parameters such as size, weight, and temperature rise. Nomographs are included to provide a close approximation for breadboarding purposes. For greater convenience, derivations of some of the parameters are also presented. Author

N73-31625*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF THE EFFECT OF INLET TURBULENCE LENGTH SCALE ON FAN DISCRETE TONE NOISE
Brent K. Hodder Sep. 1973 13 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62300) Avail: NTIS HC $3.00 CSCL 20A

Results of an experimental investigation at the Ames 40- by 80-Foot Wind Tunnel of fan rotor alone discrete tone noise is presented. The investigation examines rotor interaction with fan inlet turbulence. The importance of turbulence length scale is shown by comparing the fan radiated acoustic spectrum with and without modified turbulence length scales. A small-scale low pressure ratio fan was used for the experiment. Author

N73-31626# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron Physics.
STREAMING DUE TO A THERMAL SURFACE TENSION GRADIENT
Dag Andersson Apr. 1973 15 p refs
(TRITA-EPP-73-10) Avail: NTIS HC $3.00

Streaming in a liquid due to a thermally caused surface tension gradient is discussed semi-quantitatively and observed experimentally. The streaming is easily established in several organic compounds (with low surface tension), but only with difficulty in water and more so in metals (with high surface tension), probably due to the influence of impurities. Therefore, streaming of this kind in a weld pool, previously suggested, seems improbable. Author (ESRO)

N73-31627*# Naval Ordnance Lab., White Oak, Md.
A LARGE SUPERCONDUCTING MAGNETIC SHIELD
R. H. Lundsten and J. F. Scarzello 1 Feb. 1973 33 p refs Sponsored by NASA
(NASA-CR-135486; AD-764062; NOLTR-73-113) Avail: NTIS HC $3.75 CSCL 20/3

A large superconducting magnetic shield was designed and constructed to provide a low intensity field in a temperature controllable volume approximately 30 cm (12 in) long by 10.2 cm (4 in) in diameter. Design, construction and operating techniques are discussed and illustrated. This shield was built by the Naval Ordnance Laboratory (NOL) for the NASA Ames Research Center in support of its magnetic sensor research and lunar magnetic field modeling programs. Author (GRA)

N73-31628# Naval Undersea Warfare Center, San Diego, Calif.
ACOUSTIC SIGNAL DATA ANALYSIS AND CONVERSION SYSTEM (ASDACS)
G. P. Schumacher Jun. 1973 80 p
(SF1010316)
(AD-763326; NUC-TP-354) Avail: NTIS CSCL 20/1

The purpose of this report is to provide an up-to-date and comprehensive description of the characteristics and capabilities of the Acoustic Signal Data Analysis and Conversion System (ASDACS). The description includes both hardware and software so that the applicability of ASDACS to project requirements can be determined. The system's hardware is divided into four sections: signal conditioning, analog and digital interface with the system, control and display, and digital processing. Some of the more important applications routines are described to indicate the variety and general-purpose capability of the available programs. The programs are divided into two types: interactive demand functions which allow the operator to interactively control ASDACS from a control console and batch-process applications which are executed by the operator from the comment device (teletype). Author (GRA)

N73-31629# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
COMPARATIVE STUDIES OF THE SUPERSONIC JET NOISE GENERATED BY RECTANGULAR AND AXISYMMETRIC NOZZLES Final Report, Oct. 1971 - Dec. 1972
Khoon Cheang Low and Jean F. Louis Jun. 1973 119 p refs
(Contract DOT-TSC-142)
(PB-221855/0; DOT-TSC-OST-73-22) Avail: NTIS HC $3.00 CSCL 20A

The main purpose of the study is to develop experimental scaling laws useful for predicting the overall sound power of supersonic jets operating under a range of high stagnation temperatures and pressures and under various exit Mach numbers. A shock tube is used as a flexible tool to provide the range of high stagnation temperatures and pressures involved. Two different

nozzle configurations are examined to determine how a basic difference in shape of the jet changes the relative importance of the different noise generating mechanisms. Concurrent use of a theoretical model and experimental data allows the formulation of scaling laws for the overall sound power. GRA

N73-31630# Hughes Research Labs., Malibu, Calif.
NONLINEAR MATERIALS FOR IR IMAGE UPCONVERSION Final Report, 2 Apr. 1971 - 18 Apr. 1973
A. L. Gentile, R. C. Pastor, and V. Evtuhov Jul. 1973 43 p refs
(Contract DAHC04-71-C-0028)
(AD-763952; AROD-9664-2-P) Avail: NTIS CSCL 20/6

Synthesis techniques for the growth of new nonlinear materials including the AIIBIVC2V chalcopyrites ZnSiAs2, ZnGeP2, CdGeAs2 and ZnSiP2, as well as univalent metal iodates, including LiO3, KIO3, and TlIO3 were investigated. Techniques used involved solution growth for both types, in addition to Bridgman and vapor transport methods for the chalcopyrites. High quality single-crystal ZnGeP2 was grown from the melt; the technique was also applied to ZnSiAs2 and CdGeAs2. Powders of the various iodates were synthesized and evaluated with respect to their 1.06 micrometers doubling efficiencies. (Modified author abstract) GRA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-31631 Michigan State Univ., East Lansing.
PROTON INDUCED SPALLATION OF Ne-20 AND THE ASTROPHYSICAL PRODUCTION OF THE LITHIUM ISOTOPES Ph.D. Thesis
Lolo Marangkup Panggabean 1972 168 p
Avail: Univ. Microfilms Order No. 73-12795

Cross sections for production of masses 6 and 7 in the proton induced spallation of Ne-20 have been measured at the proton bombarding energies 30, 35, 40, and 42 MeV. The magnitudes of the mass 6 and mass 7 cross sections at each energy are equal within the experimental uncertainties, both rising from 1.5 mb at 30 MeV to 4 mb at 42 MeV. The angular distributions for both masses at all energies are very similar; they go down monotonically at back angles. Together with the cross sections for mass 6 and mass 7 that are available in the literature, the cross sections measured in this laboratory were used to calculate the ratio of the production rate of Li-2 to that of Li-6 by the protons in stellar flares. Dissert. Abstr.

N73-31632 Illinois Univ., Urbana.
THEORY OF THE MOBILITY OF IONS IN SUPERFLUID HELIUM Ph.D. Thesis
Ruben Geraro Barrera Perez 1972 174 p
Avail: Univ. Microfilms Order No. 73-9875

A microscopic formulation of the mobility of ions in superfluid helium is derived. The mobility is given in terms of the cross section for the scattering of the ions with the elementary excitations of the liquid. The phonon-limited mobility of negative ions is calculated as a function of temperature using a semiclassical model for the ion-phonon scattering. The mobility of positive and negative ions in the roton limited regime is calculated as a function of temperature. A constant scattering transition matrix element is assumed and the ion recoil is taken into account. The mobility of positive ions in dilute solutions of He3 in He4 is calculated as a function of temperature and He3 concentration. The interaction between the positive ion and the He3 quasiparticles is found to be repulsive and long range. Dissert. Abstr.

N73-31633# Communications Research Centre, Ottawa (Ontario).
A SPECTROSCOPIC DETERMINATION OF THE 3 P 0 YIELDS 3 F 2 AND 3 P 0 YIELDS 3 H 6 TRANSITIONS OF THE Pr(3 PLUS) ION IN SeOCl2:SnCl4
A. Watanabe Jul. 1973 17 p refs
(CRC-1243) Avail: NTIS HC $3.00

A spectroscopic method was used to determine the induced emission cross section for the 3 P 0 yields 3 F 2 and 3 P 0 yields 3 H 6 transitions of the Pr(3+) ions in an aprotic solvent system consisting of a mixture of SeOCl2 and SnCl4. The values obtained were 4.3 x 10 to the -19th power sq cm and 2.0 x 10 to the -19th power sq cm, respectively. The former value is five times as large as teh value 0.85 x 10 to the -19th power sq cm for the low threshold laser transition of the Nd(3+) ion in the same solvent system. Author

N73-31634# Illinois Univ., Urbana. Dept. of Physics.
A DUAL-RESONANCE MODEL WITH SPIN FOR THE REACTION, PION NUCLEON YIELDS PION OMEGA MESON NUCLEON
P. Aurenche [1973] 53 p refs
(Grant NSF GP-25303)
(ILL-(TH)-73-12) Avail: NTIS HC $4.75

A dual-resonance model with spin is constructed for the reaction pion nucleon yields pion omega meson nucleon. The invariant amplitudes are parameterized as sums of five-point (Bardakci-Ruegg) functions in such a way that the scattering amplitude satisfies the following properties: (a) correct spin-parity structure in all meson channels to leading order; (b) correct Regge limits; (c) correct residues at the lowest poles on all trajectories. The only parameters of the model are coupling constants, for which several sets of constraints are derived. A prediction is also made for the D-wave/S-wave ratio in the decay B yields omega meson. Author

N73-31635# Illinois Univ., Urbana. Dept. of Physics.
COMPARISON OF A DUAL-RESONANCE MODEL WITH SPIN WITH THE REACTIONS PION(PLUS), PROTON YIELD OMEGA MESON DELTA HYPERON (PLUS PLUS), NEGATIVE PION PROTON YIELDS OMEGA MESON NEUTRON, NEGATIVE PION PROTON YIELDS NEUTRAL RHO MESON NEUTRON AND NEGATIVE PION PROTON YIELDS NEGATIVE BARYON PROTON RESONANCE
P. Aurenche [1973] 42 p refs
(Grant NSF GP-25303)
Avail: NTIS HC $4.25

The model for pion nucleon yields pion omega meson nucleon scattering is applied to the four quasi two-body reactions pion(plus) proton yields omega meson Delta hyperon(plus plus), negative pion proton yields omega meson neutron, negative pion proton yields neutral rho meson neutron, and negative pion proton yields negative baryon proton. It is found that resonable agreement with the data is obtained for the features of the model which do not involve the B meson. It is also found that B exchange is too small to account for the unnatural parity contribution to the two omega meson production reactions, indicating that the proton-proton cut might be important in these processes. Author

N73-31636# Maryland Univ., College Park. Center for Theoretical Physics.
RADIAL EXCITATIONS IN THE SYMMETRIC QUARK MODEL 2
Y. S. Kim and Marilyn E. Woz Aug. 1973 18 p refs
(Grant NSF GP-8784)
(TR-74-018) Avail: NTIS HC $3.00

The non-strange baryonic masses are calculated using the mass formula proposed earlier and then compared with all available experimental numbers. The agreement is excellent for the n = 0 and n = 1 radial modes, and is quite good for the n = 2 multiplets. The observed masses which may belong to the n = 3 and n = 4 states seem to favor a mass formula in which the mass squared is linear in the radial quantum number. Author

N73-31637# Maryland Univ., College Park. Center for Theoretical Physics.
FINITENESS OF RADIATIVE CORRECTIONS TO SEMILEPTONIC DECAYS IN UNIFIED GAUGE THEORIES
Rabindra N. Mohapatra and Susumu Sakakibara Aug. 1973 13 p refs
(Grant NSF GP-20709)

TR-74-021) Avail: NTIS HC $3.00

Current algebra and Bjorken-Johnson-Low techniques are used to exhibit the finiteness of second order radiative corrections to strangeness-changing and strangeness preserving semileptonic weak processes in the context of an SU(2) sub L X U(1) gauge model (with the hadronic extension as suggested by Glashow, Illiopolous and Maiani) with strong interactions accounted to all orders. Author

N73-31638*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
ANALYSIS OF LOW ENERGY ELECTRONS Final Report
Richard D. Sharp 1 Jun. 1973 15 p refs
(Contract NASw-2253)
(LMSC-D350709; NASA-CR-133920) Avail: NTIS HC $3.00
CSCL 20H

Simultaneous observations of low energy electrons in the plasma sheet and in the auroral zone were analyzed. Data from the MIT plasma experiment on the OGO-3 satellite and from the Lockheed experiment on the OV1-18 satellite were processed and compared. The OV1-18 carried thirteen magnetic electron spectrometers designed to measure the intensity, angular, and energy distributions of the auroral electrons and protons in the energy range below 50 keV. Two computer programs were developed for reduction of the OV1-18 data. One program computed the various plasma properties at one second intervals as a function of Universal Time and pitch angle; the other program produced survey plots showing the outputs of the various detectors on the satellite as a function of time on a scale of approximately 100 seconds per cm. The OV1-18 data exhibit the high degree of variability associated with substorm controlled phenomena. K.M.M.

N73-31639*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
COHERENT PROPAGATION OF CHARGED PARTICLE BUNCHES IN RANDOM MAGNETIC FIELDS
James A. Earl Apr. 1973 67 p refs
(Grant NGR-21-002-066)
(NASA-CR-135492; TR-73-098) Avail: NTIS CSCL 20H

When the distribution function for energetic particles moving in interplanetary space is expressed in terms of eigenfunctions of an operator which describes pitch angle scattering by random magnetic fields, the familiar phenomenon of diffusion is the dominant solution of the transport equations provided that the spectrum of magnetic fluctuations is not too steep. However, if the power vs wavenumber spectrum of the random fields has a spectral index q greater than 2, the dominant solution of the same equations is a qualitatively different mode of transport in which density inhomogeneities propagate coherently along the guiding field with a characteristic velocity equal to half the particle speed. Extended classical transport theory is used to give a detailed treatment of the new mode and to present formulas which describe the spatial and temporal structure of the coherent disturbance. Author

N73-31640# University of South Florida, Tampa. Dept. of Physics.
LINDAR ION ACOUSTIC WAVES IN A DENSITY GRADIENT
D. Jones 15 Apr. 1973 28 p refs
(Contract AT(40-1)-4338)
(ORO-4338-2) Avail: NTIS HC $3.50

The experimental and theoretical behavior of linear ion acoustic waves in density gradients formed in a collisionless discharge plasma was studied. Both the experiment and theory show a strong spatial growth of the density perturbation n sub 1 produced by the wave when the wave propagates in the direction of increasing density and a damping when the wave propagates in the direction of decreasing density. Using the measured density profile, one finds good agreement between experiment and linearized fluid theory. Although the wave amplitude n sub 1, itself, decreases as the wave propagates into a region of lower density increases. This can be expected to lead to wave steepening and shock-like behavior. Author (NSA)

N73-31641# Oak Ridge National Lab., Tenn.
PROCEEDINGS OF HEAVY-ION SUMMER STUDY
S. T. Thornton, ed 1 Jul. 1972 644 p refs Conf. held at Oak Ridge, Tenn., 12 Jun. - 1 Jul. 1972
(Conf-720669) Avail: NTIS

Various research projects in heavy ion scattering and heavy ion reactions are reported in the fields of nuclear physics and chemistry, and atomic, solid state, and biological physics. G.G.

N73-31866* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVED SPATIAL UNIFORMITY OF BEAM-PLANE INTERACTION BY MEANS OF INVERSE RASTERING
C. G. Miller *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 78-90 refs (For availability see N73-31858 22-34)
CSCL 18H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-31642 Illinois Inst. of Tech., Chicago.
THEORETICAL STUDY OF INSTABILITY IN NONEQUILIBRIUM MAGNETOHYDRODYNAMIC PLASMAS Ph.D. Thesis
James Francis Coakley 1972 169 p
Avail: Univ. Microfilms Order No. 73-12201

The stability of a seeded inert gas plasma is considered in a theoretical analysis. Such plasmas are of interest for use in closed cycle magnetohydrodynamic power generators due to the nonequilibrium ionization which results in increased electron temperature and, thus, improved performance. The reduced performance due to nonuniformities in the bulk of the flow is attributed to large scale inhomogeneities of the streamer-type and to smaller scale striations which result from the electrothermal or ionization instability. To study these phenomena a linearized combined wave analysis is considered including the electrothermal, thermal, and magnetoacoustic wave modes along with the electromagnetic wave mode. The latter wave mode is due to the fluctuations of the magnetic field and is found to be of importance for longer wavelength disturbances. The analysis includes the effects of radiation, electron heat conduction, and convection as well as Coulomb collisions and neutral collisions. Dissert. Abstr.

N73-31643 Delaware Univ., Newark.
MICROWAVE INTERACTIONS WITH A MAGNETO-PLASMA IN THE WAVEGUIDE Ph.D. Thesis
Sumantrai Dayalbhai Patel 1973 123 p
Avail: Univ. Microfilms Order No. 73-9412

A method is described for determining the electron density and collision frequency for momentum transfer of an axially magnetized waveguide plasma. A perturbation technique is used to determine the Faraday rotation and the attenuation of the microwave signal in a pencil plasma in the resonance region. The evaluation of the electron density and the collision frequency for momentum transfer from the rotation and attenuation characteristics considering the multiple reflections in the finite plasma is discussed. The experimental measurements of the rotation and the attenuation in the resonance region show a good agreement with the theoretical characteristics obtained by the use of the perturbation method. Dissert. Abstr.

N73-31644 California Univ., Irvine.
A STATISTICAL THEORY OF MARKOVIAN PLASMA TURBULENCE Ph.D. Thesis
Jeffrey John Thomson 1972 117 p
Avail: Univ. Microfilms Order No. 73-11662

Plasma turbulence is studied under the assumption that the turbulent spectrum is sufficiently broad and that the particles undergo a Markovian interaction with the stochastic electric fields. Quasilinear theory is reviewed and its shortcomings (secularity and non-convergence) remedied by using a new particle propagator containing the perturbing effect of the turbulent fields on trajectories Dissert. Abstr.

N73-31645 New York Univ., N.Y.
DC CONDUCTIVITY OF A PARTIALLY IONIZED CESIUM PLASMA IN A MAGNETIC FIELD Ph.D. Thesis
Francis J. Murray 1972 110 p
Avail: Univ. Microfilms Order No. 73-11742

The dc electric conductivity tensor of a weakly ionized, homogeneous cesium plasma in near-thermodynamic equilibrium is investigated. The cesium plasma is contained between two coaxial tantalum cylinders separated by two dielectric end caps, which along with the cylinders, form the plasma chamber boundaries. The cylinders are radiatively heated to a temperature of 1200 K. The measured conductivities are compared to results obtained from transport theory for a weakly ionized plasma. The predicted dependences on magnetic field and neutral number density have been verified. Dissert. Abstr.

N73-31646 Maryland Univ., College Park.
A STUDY OF FLUCTUATION AND COLLISIONAL PHENOMENA IN REAL AND SIMULATION PLASMAS Ph.D. Thesis
Herman Henry Klein, Jr. 1972 179 p
Avail: Univ. Microfilms Order No. 73-11398

The probability distribution of electric fields in plasmas has been calculated for plasmas in various states of stability. A computer code which simulates plasmas has been written, and probability distributions have been determined numerically through the simulations. It was found that for plasmas in thermal equilibrium the analytic and numerical results were in good agreement, thus confirming results of existing theories for real plasmas in thermal equilibrium. However, for nonthermal plasmas, the probability can be altered significantly from that determined from plasmas in thermal equilibrium. A new theory is proposed based on the distribution of wave fields in the plasma. The results of this treatment and the results of the simulations agree favorably. Dissert. Abstr.

N73-31647# Joint Publications Research Service, Arlington, Va.
WAVE, INSTABILITIES AND ANOMALOUS DISSIPATION OF A PARAMETRIC PLASMA (IN THE STRONG ELECTROMAGNETIC FIELD OF A PUMPING WAVE)
V. P. Silin 24 Aug. 1973 31 p refs Transl. into ENGLISH from the preprint "Volny, Neustoychivosti i anomalnaya dissipatsiya parametricheskoy plazmy (vsilnom elektromagnitnom pole volny nakachki)" Moscow, no. 62, 1973 52 p
(JPRS-59885) Avail: NTIS HC $3.75

A discussion is presented on the nonlinear processes of excited waves in a plasma. Author

N73-31648*# Techtran Corp., Glen Burnie, Md.
THE WENDELSTEIN W 7 PROJECT
G. H. Wolf Washington NASA Sep. 1973 31 p Transl. into ENGLISH of "Das Projekt Wendelstein W 7", Max-Planck-Inst. fuer Plasmaphys., Garching, West Germany, report IPP-2/213, Apr. 1973 42 p
(Contract NASw-2485)
(NASA-TT-F-15111; IPP-2/213) Avail: NTIS HC $3.75 CSCL 20I

A survey is given of the Wendelstein W 7 stellarator project, with particular regards to the types of problems in plasma heating and containment which it entails, and mention of the problems involved with future larger and more powerful designs. Author

N73-31649# Technische Universitaet, Brunswick (West Germany). Fakultaet fuer Naturwissenschaftliche.
RESEARCH ON KINETIC REACTIONS OF PERSISTENT PLASMAS IN STATIONARY STREAMING NITROGEN-HELIUM MIXTURE Ph.D. Thesis [REAKTIONSKINETISCHE UNTERSUCHUNGEN AN NACHLEUCHTPLASMEN STATIONAER STROEMENDER STICKSTOFF-HELIUM-GEMISCHE]
Wolfgang Zwirner 1972 132 p refs In GERMAN
Avail: NTIS HC $8.75

The development of test equipment for analyzing the characteristics of plasma in streaming gases of nitrogen and helium is discussed. The simultaneous spectroscopic and mass spectroscopic observations of plasma is described. The chemical reactions involved in the plasma production are explained. Graphs of the ion stream thickness for various conditions of gas flow are developed. Mathematical models are provided to show the relation between the ion and molecule reactions.
Transl. by P.N.F.

N73-31650*# Kanner (Leo) Associates, Redwood City, Calif.
GENERAL CHARACTERISTICS OF HEAVY ION PLASMA CREATED BY LASER
G. Tonon Washington NASA Sep. 1973 24 p refs Transl. into ENGLISH of "Caracteristiques Generales des Plasmas d'Ions Lourds Cree par Laser", CEA, Villeneuve-Saint-Georges, France, report CEA-Conf-2022, 1972 28 p Presented at Conf. on the Sources of Multi-Charge Ions, Paris, 1972 Sponsored by NASA
(NASA-TT-F-15132; CEA-Conf-2022) Avail: NTIS HC $3.25 CSCL 20I

A synthesis of the principal results obtained during the interaction of laser radiation with matter, and particularly the results concerning the charge state, the energy, and energy distribution of ions emitted by the plasma, is presented. From these results the utilization of these plasmas as a source of heavy multicharged ions is envisaged and the characteristics of the desirable laser are defined. Author

N73-31651*# California Univ., Los Angeles. Dept. of Physics.
TURBULENCE IN ELECTROSTATIC ION ACOUSTIC SHOCKS
R. W. Means, F. V. Coroniti, A. Y. Wong, and R. B. White May 1973 61 p refs
(Grant NGL-05-007-190; Contract N00014-69-A-0200-4023; AT(04-3)-34; Grant NSF GP-22817)
(NASA-CR-135490; PPG-149) Avail: NTIS HC $5.25 CSCL 20I

Three types of collisionless electrostatic ion acoustic shocks are investigated using a double plasma (DP) device: (1) laminar shocks; (2) small amplitude turbulent shocks in which the turbulence is confined to be upstream of the shock potential jump; and (3) large amplitude turbulent shocks in which the wave turbulence occurs throughout the shock transition. The wave turbulence is generated by ions which are reflected from the shock potential; linear theory spatial growth increments agree with experimental values. The experimental relationship between the shock Mach number and the shock potential is shown to be inconsistent with theoretical shock models which assume that the electrons are isothermal. Theoretical calculations which assume a trapped electron equation of a state and a turbulently flattened velocity distrubution function for the reflected ions yields a Mach number vs potential relationship in agreement with experiment.
Author

N73-31652# Columbia Univ., New York. Plasma Lab.
INFRARED EMISSION AND 10.6-MICRONS LASER SCATTERING FROM THE DENSE PLASMA FOCUS
Richard S. Post 1973 83 p refs
(Contract AT(11-1)-2233; Grant NSF GK-26326)
(COO-2233-2; Plasma-Lab-Rept-s9) Avail: NTIS HC $6.25

An experimental study was conducted on a dense plasma focus using CO2 laser scattering and infrared bremsstrahlung emission along with the standard diagnostics of neutron and hard and soft X-ray emissions and streak and framing photography. These diagnostics help demonstrate a two-stage development of the plasma: a high-density pinch stage followed by a lower-density turbulent stage. Both stages are found to contain local sources of strong nonthermal, infrared emission with enhancements up to 1,000,000 over thermal bremsstrahlung levels. During the pinch phase, the nonthermal radiation has frequency approximately 2 omega sub p. During the low-density stage, nonthermal radiation is observed at a frequency many times higher than the average plasma frequency, and it is postulated that small current filaments (plasmoids) form that have density ten times larger than the average plasma density.
Author (NSA)

N73-31653# California Univ., Livermore. Lawrence Radiation Lab.
SELF-GENERATED MAGNETIC FIELDS AND NONTHERMAL ELECTRONS IN LASER PRODUCED PLASMAS: SIMULATION TECHNIQUES AND CALCULATIONAL RESULTS

G. B. Zimmerman, E. T. Scharleman, and L. L. Wood 27 Oct. 1972 7 p refs Presented at Plasma Phys. Meeting of the Am. Phys. Soc., Monterey,. Calif., 13 Nov. 1972 Sponsored by AEC
(UCRL-74110; Conf-721132-9) Avail: NTIS HC $3.00

The following are presented: (1) a review of the plasma interactions important to laser fusion with a description of the approximations LASNEX uses to model these interactions; (2) a more detailed treatment of the suprathermal electron scheme employed; and (3) a discussion of the MHD equations as modeled in LASNEX. NSA

N73-31654# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
DYNAMICS OF EXPANDING PLASMAS Ph.D. Thesis
J. R. Albritton 1972 216 p refs Sponsored by AEC
(COO-3577-3) Avail: NTIS HC $13.00

The following topics are described in detail: (1) the snowplow model, (2) the smooth motions of snowplow model interfaces, (3) the perturbed motions of planar snowplow model interfaces, (4) reduced descriptions of the lowest interface, and (5) internal surface stress in the lowest order snowplow. NSA

N73-31655# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasmaphysik.
INVESTIGATION OF THE STRUCTURE OF THE PLANE BOUNDARY LAYER BETWEEN THE MAGNETIC FIELD AND PLASMA Ph.D. Thesis - Tech. Hochschule, Aachen, West, Germany
H. Repp Oct. 1972 81 p refs In GERMAN
(JUL-890-PP) Avail: AEC Depository Libraries

The equilibrium structure of the boundary layer between a plane magnetic piston and a low-density plasma is studied for high but constant piston velocity (disregrading particle collisions and thermal velocities). Taking the piston as the resting system it is considered as a stationary reflection of a cold plasma jet impinging perpendicular to the boundary layer. The structure of the boundary layer is characterized by the electric and magnetic field strength, which are determined from Maxwell's equations and equations of motion for ions and electrons. The field strength is represented for terms of first order in a closed form; the terms of the zeroth order are smooth functions of the local variables, the terms of the order are oscillatory functions with space dependent wavelength and amplitude. The magnetic field oscillations disappear in the plasma, the oscillations of the electric field strength are nonlinear longitudinal electrostatic plasma waves (with phase velocity equal to piston velocity). Author (NSA)

N73-31656# Los Alamos Scientific Lab., N.Mex.
RADIAL COLLAPSE OF A DENSE PLASMA SPINDLE FOCUS
K. D. Ware and J. W. Mather Apr. 1973 7 p refs Sponsored in part by DNA
(Contract W-7405-eng-36)
(LA-5178-MS) Avail: NTIS HC $3.00

A new approach to dense plasma focus comprising two high-pressure z-pinch current sheaths collapsing to an axially symmetric spindle shaped plasma is described. The spindle focus appears to provide greater axial plasma confinement than the open ended, coaxial, dense plasma focus. A high pressure z-pinch in the proper geometry, with large diameter and small axial length, was studied to determine whether the current-shock sheath would move off the insulator and collapse radially to a high density pinch a few millimeters in diameter. The current-shock sheath moved off the insulator and collapsed symmetrically to the axis. Soft X rays were observed for about 100 nsec, and there was some evidence of neutron production above the 10 to the 8th power counts/discharge detector threshold.
Author (NSA)

N73-31657# Princeton Univ., N.J. Plasma Physics Lab.
LINEAR WAVE CONVERSION AT THE LOWER HYBRID RESONANCE
I. Fidone Apr. 1973 8 p refs
(Contract AT(11-1)-3073)
(MATT-979) Avail: NTIS HC $3.00

Linear wave conversion at the lower hybrid frequency is investigated. It is shown that total conversion takes place between the components of the energy flux in the direction of the density gradient. The power of the converted plasma wave is obtained in terms of the incident flux at the plasma boundary.
Author (NSA)

N73-31658# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
NUMERICAL MODELLING OF PLASMA CLOUDS IN THE IONOSPHERE
K. H. Lloyd and G. Haerendel Jul. 1972 89 p refs
(MPI-PAE/Extraterr-73) Avail: NTIS HC $6.50

The equations of motion, which describe the behavior of a plasma cloud in the ionosphere are solved by numerical methods. The real ionosphere is approximated by a layered model. It is found that the dominant physical processes depend on the ionospheric region into which the cloud is released. In the E layer, the main process is a continuous exchange of the ions constituting the perturbation, which results in the original cloud ions becoming imbedded in the ionosphere and drifting with it. In the F region, the exchange process is very slow, and distortion of the cloud by self-generated electric polarization fields becomes the dominant effect. A comparison of the computed distortion with observations on barium plasma clouds suggests that electrostatic coupling between the E and F layers, over the scale size of the ion clouds, is not very efficient. Author (ESRO)

N73-31659# Technische Universitaet, Brunswick (West Germany). Inst. fuer Hochspannungstechnik.
LOSS REDUCTION AT LOW TEMPERATURES IN HIGH VOLTAGE OSCILLATION CIRCUITS
D. Peier Bad Godesbert, West Ger. Bundesmin. fuer Bildung und Wiss. Dec. 1972 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-K-72-31) Avail: NTIS HC $3.75; Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 5.50 DM

Theoretical and experimental investigations on the loss of high voltage LC oscillating circuits at low temperatures were carried out. Using an equivalent oscillating circuit, the different sources of loss are determined with respect to their dependance on low temperatures. Due to the reduction of major loss sources other influences may become dominant. Possible steps for their reduction are indicated. Experimental results from cryogenic oscillating circuits are reported. At low temperature the Q-factor has a maximum value for a certain inductance to capacitance ratio. This can be used for the design of optimal circuits. The influence of the Q-factor gain on the magnetic field in the coil is investigated. ESRO

N73-31660# Technische Universitaet, Brunswick (West Germany). Inst. fuer Hochspannungstechnik.
INVESTIGATION OF SWITCHING ELEMENTS FOR ACTIVATION OF HIGH VOLTAGE OSCILLATION CIRCUITS WITH A HIGH Q-FACTOR
U. Schwarz Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Dec. 1972 25 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-K-72-32) Avail: NTIS HC $3.25; Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 4 DM

Electric switches for closing high voltage, high Q, oscillator circuits were investigated. Oscillator circuits are used in plasma physics to produce alternating magnetic fields for accelerating and stabilizing plasmas. The switch should be able to withstand a voltage of 30 kV, and, on closing, should transfer from a nonconducting to conducting state as fast as possible. The experiments were performed to determine the Q factor of the circuit from the oscillation. The properties of several switches were measured: breakdown voltage, contact resistance, time delay from first current flow to metal contact, and resistance during this time. The results show the possibility of exciting a 6 kV-1 MHz oscillating to a pulse duration longer than 200 microsec with the switches investigated. The resistance of the switch with closed contacts is in the range from 1 to 2 m ohm, and it takes from 6 to 10 microsec from the first current flow to metal contact in the switch. ESRO

N73-31661# Technische Univ., Berlin (West Germany). Sonderforschungsbereich Magnetohydrodynamik.
ANALYTICAL STUDY OF UNCOMPENSATED DC MHD CONVERTERS WITH REGARD TO THE LONGITUDINAL END EFFECT
T. Schulz Jun. 1972 38 p refs In GERMAN; ENGLISH summary
(SFB-MHD-6) Avail: NTIS HC $4.00

The theoretical investigation of dc MHD converters, including armature reaction, without secondary field compensation, is described. Electric backpaths or shunts across the outside regions of the working fluid (longitudinal ends) are also considered. In addition to the well-known losses in these regions, they cause detrimental effects in the converter section. The problem is reduced to an electromagnetic one because the hydrodynamic effects, such as the influence of the velocity profile, are neglected. The electromagnetic quantities in the MHD channel are calculated. For magnetic Reynolds numbers larger than 1, there are strong irregularities of the field and current densities along the channel (high concentrations at the fluid exit). The resultant values of power and efficiency are less favorable, compared with an ideal converter. They are plotted and discussed in detail. ESRO

N73-31662# Technische Univ., Berlin (West Germany). Sonderforschungsbereich Magnetohydrodynamik.
COMPARISON OF THE LONGITUDINAL END EFFECTS OF CONSTANT AND TRAVELING FIELD MHD CONVERTERS
T. Schulz Jun. 1972 31 p refs In GERMAN; ENGLISH summary
(SFB-MHD-7) Avail: NTIS HC $3.75

The longitudinal end effects of constant field and traveling field MHD converters are analyzed for equal idealizations. If the hydrodynamic effects are neglected and the iron conductors assumed to have an infinite magnetic conductivity, the electromagnetic quantities can be determined directly from the basic electrodynamic equations. This is done for the magnetic flux and the electric current densities in the channel, respectively, with due regard for armature reaction, including finite length of the converter. The calculations for both converter types are analogous in many ways. Longitudinal end effects are referred to physical reasons of the same kind, which lead to similar assumptions for the calculations. The results, which are different, are briefly discussed and compared. ESRO

N73-31663# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
THEORETICAL FLOW FIELD ANALYSIS OF AN ANNULAR HALL ACCELERATOR
Klaus Robert 8 Feb. 1973 44 p refs In GERMAN; ENGLISH summary
(Contract DFG-Ro-320/1)
(DLR-FB-73-45) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. 14,30 DM

The electric current density, flow velocity, and mass density of an axisymmetric plasma flow in an annular Hall accelerator were theoretically analyzed. The conditions were: steady, barotropic, and inviscid flow of a rarefied gas plasma, with an imposed axial electric field and a radial magnetic induction. Solutions were obtained by means of previously developed first-order perturbation analysis closed form solutions for supersonic and subsonic conditions and for arbitrary values of the Hall parameter. ESRO

N73-31664# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
PRESSURE DISTRIBUTION AND STABILITY OF A MAGNETIZED PLASMA WITH A NEUTRAL GAS BLANKET
B. Lehnert 19 Jun. 1973 45 p refs
(TRITA-EPP-73-12) Avail: NTIS HC $4.25

The stability properties of a steady state magnetically confined plasma, in the presence of thermonuclear reactions and surrounded by a neutral gas blanket, depend on the pressure gradient which becomes the driving force of flute-type and ballooning mode instabilities. Three problems are treated: they include the determination of the steady-state pressure gradient of a thermonuclear plasma column under the influence of the Nermst effect and of sources and sinks in the balance of matter; the treatment of power losses caused by the pressure balance in a steady state, both in connection with the fully ionized interior and the partially ionized boundary region of the plasma; and finally the stabilization of the plasma in respect to flute-type and ballooning modes by particular choices of pressure distribution and boundary conditions. ESRO

N73-31665# Versar, Inc., Springfield, Va.
THE GUIDANCE OF HIGH VOLTAGE ELECTRICAL BREAKDOWN STREAMERS BY LASER INDUCED IONIZATION IN AIR Final Scientific Report
Markels 30 Jun. 1973 67 p refs
(Contract F44620-70-C-0077; AF Proj. 9751)
(AD-763827; AFOSR-73-1209TR) Avail: NTIS CSCL 20/9

Experimental studies and theoretical analysis have shown that the breakdown path and propagation velocity of high voltage electrical streamers can be modified and controlled by laser radiation at intensities less than the optical breakdown threshold. In air at atmospheric pressure, 450 KV negative streamers have been guided along straight paths about 70 cm in length, and the propagation velocities of the streamers have been increased from 2 x 10 to the power of 7 cm/sec to 3 x 10 to the power of 8 cm/sec, by 1.06 micrometer radiation pulses of 200 Joules energy and 60 nsec half-width. Direct measurements of the degree of ionization along the laser beam path showed about 10 to the power of 10 - 10 to the power of 11 ion pairs/cc are produced at the beam intensities used in the studies. (Modified author abstract) GRA

N73-31666# Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.
DIFFUSION WAVE TECHNIQUE APPLIED TO A MAGNETIZED HELIUM POSITIVE COLUMN PLASMA Ph.D. Thesis
Richard Warren Richardson 1973 111 p refs
(Grant AF-AFOSR-1908-70)
(AD-763808; AFOSR-73-1141TR) Avail: NTIS CSCL 20/9

A new technique is developed for exciting a one-dimensional diffusion wave transverse to the magnetic field in an active helium positive column plasma. A modulated electron beam is used to produce a sinusoidal plasma density perturbation along the axis of a quiet magnetized helium positive column plasma. The perturbation in plasma density dissipates radially from the axis as a diffusion wave. Radial profiles of amplitude and phase of the perturbation are measured with a movable Langmuir probe input to a phase-lock amplifier. The transverse diffusion coefficient is obtained by fitting a diffusion model to the amplitude and phase profiles. (Modified author abstract) GRA

N73-31667# Naval Postgraduate School, Monterey, Calif.
SPECTROMETRIC AND PHOTOGRAPHIC ANALYSIS OF A LASER-PRODUCED HYDROGEN PLASMA M.S. Thesis
Kurt D. Wachsmuth Jun. 1973 51 p refs
(AD-764496) Avail: NTIS CSCL 20/9

Light from a neodymium glass laser was focused in hydrogen gas at pressures from 20 mtorr to 9.16 atm in order to produce optical breakdown. The forward scattered light from the breakdown region was spectrally analyzed with a grating spectrograph from 10,300 to 10,900 A. It was found that the spectral distributions exhibited no distinguishable frequency shift. However, the absorption of the laser light depended on frequency and gas pressure. The time dependence of the onset of absorption was determined by comparing the cell beam with a beam-splitted reference beam that bypassed the pressure cell. The light scattered at an angle of 90 was photographed with a high speed image converter camera in the framing mode. This revealed evidence of self-focusing during the time the laser light was on. The plasma parameters were calculated from the kinetic theory of ideal gases and the theory of ionized gases, assuming complete ionization. (Modified author abstract) GRA

N73-31668# Stanford Univ., Calif. Inst. for Plasma Research.
LINEAR AND NONLINEAR WAVE-PARTICLE CYCLOTRON INTERACTION FOR WHISTLER-MODE WAVES IN AN ANISOTROPIC PLASMA
C. E. Newman Jun. 1973 28 p refs
(Contract N00014-67-A-0112-0062)
(AD-763744; SU-IPR-523) Avail: NTIS CSCL 20/9

The temporal behavior of a large-amplitude whistler mode is analyzed in an anisotropic plasma. The nonlinear equation is

solved for the wave amplitude as a function of time. It is found that, in the t approaches 0- limit, the solution reproduces the linear theory. In the t approaches infinity limit the author finds that the amplitude approaches a limiting value, i.e. saturation sets in. Arguments are then given for the existence of frequency bands for which the linear growth rate and the nonlinear value of the saturated logarithmic decrement are of opposite sign. This means that for these frequencies, the linear and nonlinear theory are in conflict in their predictions of ultimate growth or damping of the wave. The reasons for and implications of this phenomenon are discussed, and a comparison with nonlinear electrostatic modes is made. Author (GRA)

N73-31669# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.
CONTINUUM THEORY OF ELECTROSTATIC PROBES IN A MODERATELY IONIZED PLASMA Interim Report
Michael S. Barad and Ira M. Cohen Jul. 1973 47 p refs
(Grant NSF GK-2281; NSF GK-1652)
(PB-222088/7; MEAM-73-1; Rept-2281/10) Avail: NTIS HC $4.50 CSCL 20I

Continuum electrostatic probe theory is developed for a collision-dominated plasma in which the ratio of charge-charge to charge-neutral collision frequencies may range between zero and unity. The former limit corresponds to the usual weakly ionized condition of earlier probe analyses, while for non-zero values of this ratio transport coefficients must be assumed to vary with position in the plasma. Electron temperature variation is allowed for through the consideration of electron energy conservation and transport. Quasilinearization is used to solve the equations numerically, and an orthnormalization technique is developed to overcome the ill-conditioning problem which often occurs in the solution of linear two-point boundary value problems. Plasma property profiles in the vicinity of the probe, for several values of collision frequency ratio and a wide range of probe potentials, are investigated. (Modified author abstract) GRA

N73-31670# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ELECTROKINETIC AND OPTICAL CHARACTERISTICS OF PLASMA IN A DISCHARGE IN HELIUM WHEN USING RESONANT NEUTRALIZATION OF HELIUM IONS ON TANTALUM
V. A. Gostev and A. D. Khakhaev 27 Nov. 1972 10 p refs Transl. into ENGLISH from the publ. "Voprosy Fiziki Nizkotemperaturnoy Plazmy" Minsk, Nauka i Tekhn., 1970 p 471-472
(AF Proj. 4152)
(AD-753520; FTD-MT-24-1534-72) Avail: NTIS CSCL 20/9

The effect of a tantalum surface bounding the lateral surface of a positive discharge column in helium at pressure of 1 to 3 mm Hg and currents of 1-600 mA in a tube with a diameter of 10 cm upon the electrical concentrations and temperatures of the electrons was experimentally investigated, and the radial distribution of atoms in states of 2 1S and 2 3S was also investigated. GRA

N73-31833 Joint Publications Research Service, Arlington, Va.
RESEARCH ON THE U-25 APPARATUS
V. A. Kirillin, V. V. Kirillov, V. G. Kirillov, Yu. M. Momotov, I. L. Mostinskiy, A. V. Nedospasov, S. A. Pashkov, M. S. Pinkhasnk, S. I. Pishchikov, L. P. Poberezhskiy et al *In its* USSR High Temp. Inst. (JPRS-59983) 7 Sep. 1973 p 103-232 refs Transl. into ENGLISH of the book "Issledovaniya na Ustanovke U-25 (I)" Moscow, Akad. Nauk SSSR, 1973 165 p (For availability see N73-31831 22-33)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-31671 Ohio State Univ., Columbus.
A MOESSBAUER EFFECT STUDY OF THE HIGH TEMPERATURE OXIDATION OF 302 STAINLESS STEEL Ph.D. Thesis
John Conrad VanKeuren 1972 320 p
Avail: Univ. Microfilms Order No. 73-11594

The oxidation of 0.0025 cm thick 302 stainless steel foils at a temperature of 910 C in air was studied by the use of the Mossbauer effect in conjunction with electron microprobe analysis, gravimetric measurement, and optical microscopy. It was found that a martensitic phase is induced by oxidation in the normally austenitic 302 stainless steel. No definitive statement can be made as to whether the martensite forms at temperature or is induced by cooling to room temperature. It was found that the presence of the martensite could be associated with areas of the sample below 16% Cr (areas near the alloy/oxide interface). A possible role of the martensite phase in breakaway is discussed. It was also found that oxidation initially induced a positive change in the isomer shift of the austenitic resonance. A semiempirical technique was developed to analyze the isomer shift in transition metal alloys. Dissert. Abstr.

N73-31672 Ohio State Univ., Columbus.
TWO DIMENSIONAL NUMERICAL ANALYSIS OF SEMICONDUCTOR DEVICES: APPLICATION TO BIPOLAR TRANSISTORS Ph.D. Thesis
David Dean Meyer 1972 120 p
Avail: Univ. Microfilms Order No. 73-11540

Two-dimensional numerical analysis of semiconductor devices which considers degenerate material effects of formulated and presented. Also, an improved and extended two-dimensional numerical method for the solution of the diffusion equation is introduced which is capable of considering variations in the impurity diffusion constant as a function of position. The two numerical methods are applied to an integrated silicon N-P-N transistor model which includes the isolation regions and a buried layer. The diffusion differences between the emitter push and the idealized transistor models are illustrated. Fermi-Dirac statistics are used in the semiconductor device analysis in order to accurately model the degenerate emitter and base regions. The numerical formulations are given in detail as are the computer programs which are written in FORTRAN. The current state of the semiconductor device analysis algorithms is discussed as are the problem areas which restrict the algorithms from operating correctly. Dissert. Abstr.

N73-31673 Michigan Univ., Ann Arbor.
PRODUCTION AND CHARACTERIZATION OF STRAIN CRYSTALLIZED POLYMER MORPHOLOGIES Ph.D. Thesis
Dennis Louis Krueger 1972 287 p
Avail: Univ. Microfilms Order No. 73-11183

The preparation conditions, morphology, and properties of polymers crystallized from stirred dilute solutions and from sheared polymer melts are investigated. For the study of crystallization from a stirred solution, a simple stirring apparatus was designed to investigate the effects of stirring time and temperature and washing and cooling conditions on the morphology of the resulting crystalline fibers. For the study of crystallization from sheared polymer melts, a Couette-type shearing apparatus was designed to investigate the effect of shear rate, strain, temperature, and cooling rate on the rate of crystallization and on the morphology and properties of the resulting polymer. The morphological study included the use of wide and small angle X-ray diffraction and electron microscopy. The investigation revealed that the rates and temperatures to crystallization were higher in both processes compared to quiescent strain-free systems. Dissert. Abstr.

N73-31674*# Kanner (Leo) Associates, Redwood City, Calif.
THE HOMOGENEITY REGIONS OF THE SUPERCONDUCTIVE PHASES IN THE MOLYBDENUM-PLATINUM SYSTEM
R. Flukiger Washington NASA Oct. 1973 5 p Transl. into ENGLISH from J. Less Common Metals (Lausanne), v. 32, no. 2 Aug. 1973 p 222 and 224
(Contract NASw-2481)
(NASA-TT-F-15139) Avail: NTIS HC $3.00 CSCL 11F

The superconductivity temperatures of ordered and disordered structures are discussed. Tests conducted show that the measurement of T sub c after hardening makes it possible to determine the annealing temperature within + or - 20 C. This property is observed in other hexagonal phases based on Mo

and W, which also undergo an order-disorder transformation.
Author

N73-31675*# Georgia Inst. of Tech., Atlanta.
COMPLEX PERMITTIVITY MEASUREMENTS DURING HIGH TEMPERATURE RECYCLING OF SPACE SHUTTLE ANTENNA WINDOW AND DIELECTRIC HEAT SHIELD MATERIALS
Harold L. Bassett and Steve H. Bomar, Jr. Washington NASA Sep. 1973 72 p refs
(Contract NAS1-11267)
(NASA-CR-2302; A-1389) Avail: NTIS HC $3.50 CSCL 09C

The research performed and the data obtained on candidate space shuttle antenna window and heat shield materials are presented. The measurement technique employs a free-space focused beam microwave bridge for obtaining RF transmission data, and a device which rotates a sample holder which is heated on one side by natural gas-air flames. The surface temperature of each sample is monitored by IR pyrometry; embedded and rear surface thermocouples are also used in obtaining temperature data. The surface of the sample undergoing test is subjected to approximately the same temperature/time profile that occurs at a proposed antenna position on the space shuttle as it re-enters. The samples are cycled through ten of these temperature profiles to determine the recycling effects. Very little change was noted in the materials due to the recycling. Author

N73-31676*# Kanner (Leo) Associates, Redwood City, Calif.
SUPERCONDUCTIVE ENERGY STORAGE
S. L. Wipf Washington NASA Sep. 1973 43 p refs Transl. into ENGLISH of "Supraleitende Energiespeicher", Max-Planck-Inst. fuer Plasmaphys., Garching, West Germany, report IPP-2/211, Feb. 1973 39 p
(Contract NASw-2481)
(NASA-TT-F-15109; IPP-2/211) Avail: NTIS HC $4.25 CSCL 20L

Superconductive energy storage is surveyed with regard to advantages, problems and applications. Advantages are large capacity and discharge rate, and relatively high energy density. Problems are optimization of coil form, discharge, development of a suitable superconducting switch, and minimization of alternating-current losses in order to maintain superconduction during discharge. Some proposed solutions are outlined. Envisioned applications include pinch experiments in plasma physics directed toward a pulsed fusion reactor, and power supply for lasers. Author

N73-31677# California Univ., Berkeley. Lawrence Berkeley Lab.
SUMMARY OF INTERNATIONAL PROGRESS ON SUPERCONDUCTING MAGNETS
W. S. Gilbert Mar. 1973 8 p refs Presented at 5th Particle Accelerator Conf., San Francisco, 5-7 Mar. 1973
(Contract W-7405-eng-48)
(LBL-1703; Conf-730310-35) Avail: NTIS HC $3.00

Superconducting pulsed magnets for use in high field synchrotrons, storage rings, dc dipoles, and quadrupoles for use in beam transport lines are reviewed. Operating and construction plans for the immediate future are presented. Author (NSA)

N73-31678# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
DUCTILE SUPERCONDUCTING COPPER BASE-ALLOYS
C. C. Tsuei Feb. 1973 12 p refs
(Contract AT(04-3)-822)
(CALT-822-51) Avail: NTIS HC $3.00

A new class of ductile superconductors was prepared by casting and appropriate heat treatments. These alloys superconduct between 4 and 18 K and contain at least 90 at.% copper and a superconducting phase such as NB3Sn or Nb. They can be processed into wires by conventional metallurgical techniques. Author (NSA)

N73-31679# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
SUPERCONDUCTIVITY OF COPPER CONTAINING SMALL AMOUNTS OF NIOBIUM
C. C. Tsuei and R. Newkirk Jan. 1973 28 p refs
(Contract AT(04-3)-822)
(CALT-822-50; Rept-43) Avail: NTIS HC $3.50

Superconductivity of copper containing small amounts of niobium was investigated by measuring the electrical resistivity, superconducting volume fraction and by metallographic studies. Small amounts of niobium added to copper have a drastic effect on the low temperature resistivity of the alloys. The annealed alloy Cu99.5Nb0.5 shows zero resistance at a current density of 200 A/ sq cm below 3 K. The estimated superconducting volume fraction of this alloy at 2. K is about 50 times the physical volume fraction of the Nb in the alloy. When more Nb is added these effects unexpectedly become much smaller than those observed in the dilute alloys (< 1.5 at. % Nb). Metallographic results indicate that in all the Cu-Nb alloys studied there are two distinct types of Nb particles in the Cu matrix. The large particles randomly distributed in the alloy are probably at high temperature when the bulk of the alloy is still in liquid state.
Author (NSA)

N73-31680# Siemens-Schuckertwerke A.G., Erlangen (West Germany). Forschungslab. Strahlungsmesstechnik.
NEW SEMICONDUCTORS FROM ELEMENTS WITH HIGH ATOMIC NUMBER FOR THE DETECTION OF GAMMA-RAYS AND X-RAYS [NEUE HALBLEITER AUS ELEMENTEN MIT HOHER KERNLADUNGSZAHL ZUM NACHWEIS VON GAMMA-UND ROENTGENSTRAHLEN]
W. R. Willig Bonn Bundesmin. fuer Forsch. und Technol. Apr. 1973 74 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-K-73-09) Avail: NTIS HC $5.75; Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 14,30 DM

A 10% resolution gamma spectra was obtained using mercury iodide single crystal grown by transport or solution techniques. The detector worked at room temperature with high absorption coefficient for gamma quanta and consequently reduced thickness compared to germanium detector characteristics. Performance characteristics such as product of lifetime and mobility are presented for different materials. ESRO

N73-31681# Army Electronics Command, Fort Monmouth, N.J.
BULK SEMICONDUCTOR DIELECTRIC WAVEGUIDE FUNCTIONAL CIRCUITS
M. M. Chrepta and H. Jacobs Jul. 1973 35 p
(DA Proj. 1T0-61101-A-91A)
(AD-763888; ECOM-4135) Avail: NTIS CSCL 09/1

A new system is proposed for millimeter wave integrated circuits. It is suggested that high resistivity silicon be used as a medium for a dielectric waveguide. With the advent of high resistivity silicon, propagation can occur with relatively low loss. Furthermore, since the medium is a semiconductor compatible with active devices, it is proposed that active devices can be constructed directly in the semiconductor dielectric guide or appendaged directly on the surface. The basic approach is similar to that used in integrated optics, except that the medium for millimeter wave guidance is a semiconductor and the control devices rely on conductivity modulation rather than on electro-optical effects. Some particular devices suggested are oscillators, mechanical and electronic phase shifters, amplitude modulators (switches), and detectors. The first of such devices investigated has been the electronic phase shifter. Related theory and experiments are reported here. In addition, preliminary results on oscillators imbedded in a dielectric resonator are presented.
Author (GRA)

N73-31682# City Coll. of the City of New York. Dept. of Physics.
PROPERTIES OF DILUTE AND CONCENTRATED MAGNETIC ALLOYS Final Report
Myriam P. Sarachik and Frederick W. Smith 2 Apr. 1973 11 p refs
(Grant AF-AFOSR-1953-70; AF Proj. 9764)
(AD-763820; AFOSR-73-1115TR) Avail: NTIS CSCL 20/12

Various experiments such as susceptibility, resistivity, magnetoresistance, thermoelectric power and specific heat, were performed on selected alloy systems, both dilute and concentrated. Results were obtained, some of them useful in testing existing

theory, and others instrumental in prompting further theoretical work on Kondo systems and on spin fluctuations. The work on concentrated alloys showed clear evidence for the existence of giant magnetic clusters, and recent theoretical work has accounted for these measurements in terms of intra- and inter-cluster interactions. Author (GRA)

N73-31683# Delaware Univ., Newark. Dept. of Physics.
LUMINESCENT DEFECTS IN COMPOUND SEMICONDUCTORS Final Report, 1 Jun. 1963 - 28 Feb. 1973
Ferd Williams 28 Feb. 1973 13 p refs
(Grant DA-ARO(D)-31-124-G446; DA-ARO(D)-31-124-G815; DA Proj. 200-61102-B-11B)
(AD-764278; AROD-4169-20-P) Avail: NTIS CSCL 20/12

The research described herein contributes to the understanding of the electronic states, electronic transport and radiative transitions of pure and doped single crystals of compound semiconductors, particularly of II-VI luminescent semiconductors. Both homogeneous single crystals and materials with graded composition are investigated. A combination of experimental and theoretical methods are used. Among the results of these investigations are (a) an advance in the understanding of donor-acceptor pairs and of higher associates; (b) predictions and observations of phenomena unique to luminescent semiconductors with monotonically graded composition and (c) analyses of the electrical and optical properties of amorphous materials which have graded globular inhomogeneities in structure or composition. Author (GRA)

N73-31684# Naval Postgraduate School, Monterey, Calif. Dept. of Physics and Chemistry.
AN ELECTRON PARAMAGNETIC RESONANCE STUDY OF INDIUM DOPED ZINC OXIDE M.S. Thesis
Coenraad VanDerSchroeff Jun. 1973 98 p refs
(AD-764490) Avail: NTIS CSCL 20/12

Samples of zinc oxide doped with indium have been prepared using the vapor transport method. Concentration of dopant is controlled by appropriate mixing of the oxides of indium and zinc. When ZnO is mechanically damaged, three lines in the EPR spectrum with g-values at 2.0052, 2.0136, 2.0184 are induced. These are attributed to the interaction of adsorbed species and induced paramagnetic centers in the crystal. The relative intensity of the lines is affected by indium doping. (Modified author abstract) GRA

N73-31685# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
PHYSICS OF SEMICONDUCTOR LUMINESCENCE AND HIGH-TEMPERATURE SEMICONDUCTORS Final Report, 1 Jun. 1968 - 14 Mar. 1973
Robert H. Rediker and Clifton G. Fonstad 2 Jul. 1973 24 p refs
(Grant AF-AFOSR-1571-68; AF Proj. 9763)
(AD-763840; AFOSR-73-1211TR) Avail: NTIS CSCL 20/12

A new luminescence modulation effect was observed in Si and Ge and a new negative resistance phenomenon discovered in Ge. The intrinsic energy band levels in (Al,Ga)As were studied as a function of alloy composition, and the modulation of (Al,Ga)As luminescence by surface fields investigated. Higher quality crystals of the wide band-gap semiconductor stannic oxide than previously available were grown and extensive studies were undertaken of SnO_2's electrical and optical properties, crystal growth, and device technology. Author (GRA)

N73-31686# Army Foreign Science and Technology Center, Charlottesville, Va.
LOW TEMPERATURE THERMOELECTRIC MICROREFRIGERATOR
V. Martynovskii 15 Mar. 1973 5 p refs Transl. into ENGLISH from "Nizkotemperaturnye Termoelektricheskie Materialy" Kiev, 1970 p 165-168
(AD-764171; FSTC-HT-23-2020-72) Avail: NTIS CSCL 13/1

The report discusses three-cascade thermoelectric microcooler. GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-31687# Gorakhpur Univ. (India). Dept. of Chemistry.
COMBUSTION OF POLYSTYRENE AND OXYGEN-STYRENE COPOLYMER/AMMONIUM PERCHLORATE PROPELLANTS
R. P. Rastogi, K. Kishore, and Gurdip Singh 13 Jul. 1973 25 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal, January 1974
Avail: NTIS HC $3.25

A comparative study of combustion of polystyrene and oxygen-styrene copolymer/ammonium perchlorate (AP) composites has been made in order to investigate the role of peroxide-linkage in the latter and to study the role of surface reactions in combustion. For this purpose, burning rate, thermal degradation kinetics, heats of combustion, flame temperature and surface temperature have been measured. The differential scanning calorimetry of the propellants has also been done. Author

N73-31688*# Rocketdyne, Canoga Park, Calif.
REGENERATIVELY COOLED ROCKET ENGINE FOR SPACE STORABLE PROPELLANTS Interim Report, May 1970 - Dec. 1971
W. R. Wagner and B. J. Waldman Mar. 1973 335 p refs Prepared for JPL
(Contract NAS7-765)
(NASA-CR-133915; R-8866) Avail: NTIS HC $18.75 CSCL 21I

Analyses and experimental studies were performed with the OF2 (F_2/O_2)/B2H6 propellant combination over a range in operating conditions to determine suitability for a space storable pressure fed engine configuration for an extended flight space vehicle configuration. The regenerative cooling mode selected for the thrust chamber was explored in detail with the use of both the fuel and oxidizer as coolants in an advanced milled channel construction thrust chamber design operating at 100 psia chamber pressure and a nominal mixture ratio of 3.0 with a 60:1 area ratio nozzle. Benefits of the simultaneous cooling as related to gaseous injection of both fuel and oxidizer propellants were defined. Heat transfer rates, performance and combustor stability were developed for impinging element triplet injectors in uncooled copper calorimeter hardware with flow, pressure and temperature instrumentation. Evaluation of the capabilities of the B2H6 and OF2 during analytical studies and numerous tests with flow through electrically heated blocks provided design criteria for subsequent regenerative chamber design and fabrication. Author

N73-31689# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
OPTIMIZATION OF C3 AND C4 OLEFIN OLIGOMER SUPERSONIC FUELS BY n-PARAFFINS [OPTIMIERUNG VON UEBERSCHALLKRAFTSTOFFEN AUS OLIGOMERISATEN VON C3- UND C4- OLEFINEN DURCH n-PARAFFINE]
Robert Erlmeier 17 Jan. 1973 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-32) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 11,50 DM

Fuels from completely hydrogenated low molecular C3/C4 olefin polymers are suitable as supersonic fuels due to their high stability, but in general, their low temperature viscosities and vapor pressures exceed limitations. The optimization of C3/C4-polymer fuels by straight chain hydrocarbons containing 10 to 16 carbon atoms is discussed. The influence of n-paraffins on the freezing point, low temperature viscosity, vapor pressure, energy content, and combustion characteristics of four polymer fuels were investigated. Low temperature viscosity, vapor pressure and luminometer number can be optimized on account of the freezing point to such an extent that they meet current maximum requirements for Mach 3 conditions. Author (ESRO)

N73-31690# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION INTO THE METHODS OF DETECTING DEWETTED ZONES IN SOLID ROCKET PROPELLANTS USING HOLOGRAPHIC INTERFEROMETRY M.S. Thesis
Donald Arthur Hallwachs Jun. 1973 68 p refs
(AD-764470) Avail: NTIS CSCL 21/9

An investigation was conducted into the possibility of visually detecting a dewetted zone in a solid rocket propellant through the use of holographic interferometry. Techniques used were simple strain, residual strain and time-average holography. As a basis for comparison with experimental data a finite element program was used to model the test samples. Author (GRA)

N73-31691# Naval Postgraduate School, Monterey, Calif.
INTERNAL BALLISTICS OF SOLID FUEL RAMJETS M.S. Thesis
Lowell David Boaz Mar. 1973 97 p refs
(AD-764491) Avail: NTIS CSCL 21/4

An experimental investigation of the internal ballistics of solid fuel ramjets was conducted in order to determine the regression rate of the fuel as a function of chamber pressure, inlet air temperature, and air flux rate, and to model the flow in solid fuel ramjets which use sudden expansion flame-holders at the inlet. In addition, flame stabilization limits were investigated. A computer solution for the non-reacting flow field gave results in good agreement with experiments. (Modified author abstract) GRA

N73-31692# Georgia Univ., Athens. Dept. of Chemistry.
DENSITY MATRIX APPROACH TO ATOMIC STRUCTURE OF SOLID STATE ELECTRONIC DEVICES AND ROCKET PROPELLANTS Final Scientific Report
Darwin W. Smith 29 Jun. 1973 9 p refs
(Grant AF-AFOSR-1655-69; AF Proj. 9767)
(AD-763815; AFOSR-73-1116TR) Avail: NTIS CSCL 07/4

The report is a brief survey of density matrix methods developed and applied in the investigation of the electronic structure of atoms. Accurate atomic wavefunctions have been generated, and then analyzed using density matrix techniques. A comparison of ground and excited state wavefunctions showed the changes in the density matrices which occur on excitation. Atomic density matrices were partitioned into an uncorrelated reference state and a correlation in order to study correlation effects. The Hyper-Hartree-Fock scheme was subjected to a density matrix analysis to show the problems which can arise when a state is not N-representable. A decomposition of the energy of an atom into geminal contributions, and a comparison of the Coulomb and Fermi correlation effects was made. A perturbation expansion of the natural orbitals of two-electron atoms in inverse powers of the nuclear charge was made with the hope of providing information which can be used in building inner shells of larger atoms. Author (GRA)

N73-31693# Esso Research and Engineering Co., Linden, N.J.
EVALUATION OF THE HAZARD OF STATIC ELECTRICITY IN NONMETALLIC POL SYSTEMS-STATIC EFFECTS IN HANDLING JET FUEL IN FIBERGLASS REINFORCED PLASTIC PIPE Technical Report, Jun. 1971 - Jun. 1972
Kenneth C. Bachman and J. C. Munday Kirtland AFB, N. Mex. AFWL Jun. 1973 218 p refs
(Contract F29601-71-C-0071)
(AD-764358; RL-4PD-72; AFWL-TR-72-90) Avail: NTIS CSCL 21/4

There is an increasing interest in fiberglass reinforced plastic (FRP) pipe for minimizing contamination in ground handling of aviation fuels. The report presents the results of a literature search and experimental study conducted to determine if static electricity hazards would be increased by substituting FRP for metal pipe in such systems. Experiments were conducted in 6 inch diameter, matched volume, carbon steel and Bondstrand 2000 pipes at four fuel conductivities between 0.2 and 5.5 CU and at flow rates between 200 and 1500 GPM at controlled temperatures. Charge generation in the pipes was low; generation in FRP was generally less than in steel. Relaxation in FRP pipe depended on fuel polarity; on the average, relaxation was 8 percent faster, with negatively-charged fuel and 30 percent slower with positively-charged fuel than in steel. (Modified author abstract) GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-31694*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN 8-cm ELECTRON BOMBARDMENT THRUSTER FOR AUXILIARY PROPULSION
Wayne R. Hudson and Bruce A. Banks 1973 13 p refs
Proposed for presentation at the 10th Elec. Propulsion Conf., Lake Tahoe, Nev., 31 Oct.-2 Nov. 1973; sponsored by AIAA
(NASA-TM-X-68296; E-7645) Avail: NTIS HC $3.00 CSCL 21C

Thruster size, beam current level, and specific impulse trade-offs are considered for mercury electron bombardment ion thrusters to be used for north-south station keeping of geosynchronous spacecraft. An 8-cm diameter thruster operating at 2750 seconds specific impulse at thrust levels of 4.4 mN (1 m1b) to 8.9 mN (2 m6b) with a design life of 20,000 hours and 10,000 cycles is being developed. The thruster will have a dished two-grid system capable of thrust vectoring of + or - 10 degrees in two orthogonal directions. A preliminary thruster has been fabricated and tested; thruster performance characteristics have been determined at 4.45, 6.68, and 8.90 millinewtons. Author

N73-31695# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
HIGH PRESSURE STAGE OUTPUT OF MODERN TURBOREACTOR TURBINES [RENDEMENT DE L'ETAGE HAUTE PRESSION DES TURBINES DE TURBOREACTEURS MODERNES]
P. Martinat [1972] 27 p In FRENCH Presented at 1st Intern. Symp. on Air Breathing Engines, 17-23 Jun. 1972
Avail: NTIS HC $3.50

An analysis was made of the factors influencing high pressure efficiency of turboreactor turbines. Data cover energy degradation as a function of technology, environment, blade cooling, and blade aerodynamics. Transl. by E.H.W.

N73-31696# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
DEVELOPMENT OF HIGH PERFORMANCE ANNULAR COMBUSTION CHAMBERS BY SNECMA [LE DEVELOPPEMENT DES CHAMBRES DE COMBUSTION ANNULAIRES A HAUTES PERFORMANCES A LA SNECMA]
J. Caruel [1972] 27 p refs In FRENCH Presented at 1st Intern. Symp. on Air Breathing Engines, 17-23 Jun. 1972
Avail: NTIS HC $3.50

A survey was made of annular combustion chamber technology at SNECMA. Chamber performance and pressure and temperature effects are discussed as well as chamber advantages and disadvantages. The use of such chambers in turboreactors is considered. Transl. by E.H.W.

N73-31697*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID ROCKET ENGINE FLUID-COOLED COMBUSTION CHAMBERS Space vehicle design criteria (chemical propulsion)
Apr. 1972 120 p refs
(NASA-SP-8087) Avail: NTIS HC $4.25 CSCL 21H

A monograph on the design and development of fluid cooled combustion chambers for liquid propellant rocket engines is presented. The subjects discussed are (1) regenerative cooling, (2) transpiration cooling, (3) film cooling, (4) structural analysis, (5) chamber reinforcement, and (6) operational problems. Author

N73-31698*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL STUDY OF ROTATING STALL IN HIGH-PRESSURE STAGES OF AN AXIAL FLOW COMPRESSOR

V. S. Beknev, A. V. Zemlyanskiy, and R. Z. Tumashev Washington NASA Sep. 1973 10 p refs Transl. into ENGLISH from Mashinostr. (Moscow), no. 8, 1970 p 116-122
(Contract NASw-2485)
(NASA-TT-F-15115) Avail: NTIS HC $3.00 CSCL 21E

An experimental study of rotating stall in axial-flow compressor stages with different types of profiling along the blade height and with different calculated regimes of flow past a profile in the cascade was conducted. It is found that, in spite of the different safety margins with respect to boundary layer separation in the cascades of the different stages, their boundaries of stable operation are almost the same. It is shown that profiling taking into account end effects has a stabilizing influence and leads to a smoother transition to the rotating stall regime. The flow in rotating stall zones is shown to be of three-dimensional nature. It is shown that this three-dimensional structure can be detected with the aid of straight and L-shaped tensoanemometer probes. Author

N73-31699*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DUAL CYCLE AIRCRAFT TURBINE ENGINE Patent Application
Mark R. Nichols, inventor (to NASA) Filed 6 Sep. 1973 16 p
(NASA-Case-LAR-11310-1; US-Patent-Appl-SN-394898) Avail: NTIS HC $3.00 CSCL 21E

A method and apparatus applicable to jet engines is presented for improving operating efficiency over broad ranges of flight conditions and for reducing engine noise output in take-off and landing by controlling the airflow entering and exiting the engines. A turbojet engine apparatus is described which operates efficiently at both subsonic and supersonic speeds and a method is described which enables a turbofan with an associated satellite turbojet or turbofan to operate more efficiently at both subsonic and supersonic speeds. In both cases, take-off and landing noise is reduced substantially. The apparatus consists essentially of arranging for two separate portions of an engine to act upon one airstream or, alternately, to operate on independent airstreams. NASA

N73-31700*# Techtran Corp., Glen Burnie, Md.
INFLUENCE OF TRANSIENT CONDITIONS ON OVERALL SERVICE LIFE OF TURBINE BLADES
G. N. Tretyachenko Washington NASA Sep. 1973 8 p refs Transl. into ENGLISH from Probl. Proch. (USSR), v. 5, no. 3, Mar. 1973 p 3-6
(Contract NASw-2485)
(NASA-TT-F-15113) Avail: NTIS HC $3.00 CSCL 21E

It is shown that, in spite of their relatively short duration, transient modes of operation of the type occurring during takeoff, landing, and engine tests have a tremendous effect on the service life of turbine blades. In view of this, it is suggested to carry out accelerated tests by determining the time to failure at steady modes of operation on the basis of data obtained with cylindrical samples, and at transient modes of operation, on the basis of tests performed with actual blades under simulated conditions. Author

N73-31701*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE CHARACTERIZATION TESTS OF THREE 0.44-N (0.1 lbf) HYDRAZINE CATALYTIC THRUSTERS
P. I. Moynihan and R. A. Bjorklund 1 Sep. 1973 68 p refs
(Contract NAS7-100)
(NASA-CR-135489; JPL-TR-32-1584) Avail: NTIS HC $5.50 CSCL 21H

The 0.44-N (0.1-lbf) class of hydrazine catalytic thruster has been evaluated to assess its capability for spacecraft limit-cycle attitude control with thruster pulse durations on the order of 10 milliseconds. Dynamic-environment and limit-cycle simulation tests were performed on three ocmmercially available thruster/valve assemblies, purchased from three different manufacturers. The results indicate that this class of thruster can sustain a launch environment and, when properly temperature-conditioned, can perform limit-cycle operations over the anticipated life span of a multi-year mission. The minimum operating temperature for very short pulse durations was determined for each thruster. Pulsing life tests were then conducted on each thruster under a thermally controlled condition which maintained the catalyst bed at both a nominal 93 C (200 F) and 205 C (400 F). These were the temperatures believed to be slightly below and very near the minimum recommended operating temperature, respectively. The ensuing life tests ranged from 100,000 to 250,000 pulses at these temperatures, as would be required for spacecraft limit-cycle attitude control applications. Author

N73-31702*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF A WATER TABLE SIMULATION OF A TRANSPIRATIONALLY COOLED NOZZLE
Albert F. Kascak Washington Oct. 1973 26 p refs
(NASA-TM-X-2884; E-7524) Avail: NTIS HC $3.00 CSCL 20D

Two flow models were formulated: for a no-mixing and a complete-mixing boundary layer. The approach taken assumes inviscid flow and constant pressure in the transverse direction. The models are simple enough so that extending them to apply to a gas nozzle, including heat transfer and density differences, should be possible. Both models predict experimental photographic data with similar results; but inherent two dimensional and parallax errors preclude choice of the best model. In general, the boundary layer thickens repidly near the start of injection because of low acceleration forces; it thins near the throat because of high acceleration forces. The transpiration fluid increases the radius of curvature near the throat and decreases the divergence angle of the free flow downstream of the throat. Author

N73-31703# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
METHODS AND APPARATUS FOR THE RESEARCH OF INJECTION PROCESSES IN STREAMING MEDIA [METHODEN UND ANLAGEN ZUR UNTERSUCHUNG VON EINSPRITZVORGAENGEN IN STROEMENDE MEDIEN]
Kurt Wanders and Herbert Wiegand 5 Jul. 1972 39 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-72-19) Avail: NTIS HC $4.00; DFVLR, Porz, West Ger. 25,30 DM

A survey of the methods for obtaining equal size, liquid droplets by injection in fluid flow is presented. Liquid jet decay produces equivolume drops only if the Rayleigh jet decay conditions are taken into acount. If the production frequency is recorded with electronic counter, each drop is related to a time, starting with injection. In connection with suitable optical methods, especially equidensitometry and holography, injection phenomena in fluid flow may be studied. Special equipment was developed for investigating two phase flow in a large temperature and pressure range. ESRO

N73-31704# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
COMPRESSOR STALL ANTICIPATION Final Report, Jan. 1972 - Mar. 1973
Stephen B. Tucker Mar. 1973 82 p refs
(Contract F33615-72-C-1886; AF Proj. 0100; AF Proj. 3066) (AD-763816; R73AEG159; AFAPL-TR-73-53) Avail: NTIS CSCL 21/5

The report describes a program whose objective was to continue to investigate compressor parameters during pre-stall conditions and to expand the analytical predictability of these parameters. The performance parameters (delta P/P and delta P/Q) were analyzed on a steady state basis whereas the high frequency pressure data were analyzed by spectral and broadband noise analysis techniques. The results obtained from the data were limited somewhat due to intermittent failures in the high response sensors but the dalta P/Q parameter as analyzed by Wright-Patterson Air Force Base shows significant promise as a stall anticipation signal. (Modified author abstract) GRA

N73-31705*# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT TEST OF THE THIOKOL TE-M-616-01 SOLID-PROPELLANT ROCKET MOTOR Final Report
H. L. Merryman AEDC Aug. 1973 48 p refs Sponsored in part by NASA
(NASA-CR-135485; AD-764359; ARO-ETF-TR-73-122; AEDC-TR-73-122) Avail: NTIS HC $4.50 CSCL 21/8

One Thiokol Chemical Corporation TE-M-616-01 solid-propellant rocket motor was successfully fired at an average simulated altitude of 103,000 ft while spinning at 105 rpm after being temperature conditioned at 5 plus or minus 5F for a minimum of 34 hr. In addition, the aft six inches of the nozzle exit cone was cooled to about -195F immediately prior to ignition. The program objectives were to determine vacuum ballistic performance, altitude ignition characteristics, motor temperature-time histories, structural integrity of motor components, and the lateral (nonaxial) thrust vector. The applicable data were used to demonstrate compliance of the motor with requirements set forth in Communication Research Center Specification SS09-04.
Author (GRA)

N73-31864* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF PROPULSION FOR HIGH ATMOSPHERIC PRESSURE OR DENSE ENVIRONMENTS
G. Varsi, L. H. Back, and W. L. Dowler *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 45-52 refs (For availability see N73-31858 22-34)
CSCL 21H

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-31706 Maryland Univ., College Park.
MODULATION OF LOW ENERGY COSMIC RAYS Ph.D. Thesis
James William Sari 1972 126 p
Avail: Univ. Microfilms Order No. 73-11412

Recent theories have related the propagation and diffusion of cosmic rays to the power spectrum of the interplanetary magnetic field. The power spectrum-diffusion coefficient relation at low energies (less than 100 MeV) was tested where the validity of the theories has been in doubt. A first order perturbation solution of the Fokker-Planck equation governing the diffusion, convection and adiabatic deceleration of galactic cosmic rays in the solar medium is found to relate intensity fluctuations of low energy cosmic rays to local changes in the propagation parameters. Diffusion coefficients are calculated from interplanetary magnetic field data obtained by Pioneer 6 in 1965/1966. These are compared to simultaneous observations by IMP 3 of the proton flux in three energy channels (20-40, 40-60, 60-80 MeV). Results show that the diffusion coefficient-power spectrum relation is valid to proton energies as low as 50 MeV. Dissert. Abstr.

N73-31707*# Aerospace Corp., El Segundo, Calif.
SOLAR FLARE PREDICTIONS AND WARNINGS Final Report
K. P. White, III and E. B. Mayfield 6 Jul. 1973 71 p refs
(Contract NAS2-7292)
(NASA-CR-114635) Avail: NTIS HC $5.75 CSCL 03B

The real-time solar monitoring information supplied to support SPARCS-equipped rocket launches, the routine collection and analysis of 3.3-mm solar radio maps, short-term flare forecasts based on these maps, longer-term forecasts based on the recurrence of active regions, and results of the synoptic study of solar active regions at 3.3-mm wavelength are presented. Forecasted flares in the 24-hour forecasts were 81% accurate, and those in the 28-day forecasts were 97% accurate. Synoptic radio maps at 3.3-mm wavelength are presented for twenty-three solar rotations in 1967 and 1968, as well as synoptic flare charts for the same period. Author

N73-31708*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROPORTIONAL COUNTER OBSERVATIONS OF DISCRETE GALACTIC X-RAY SOURCES Ph.D. Thesis - Maryland Univ.
Axel Ferdinand Brisken Aug. 1973 193 p refs
(Grant NGL-21-002-033)
(NASA-TM-X-70463; X-660-73-245) Avail: NTIS CSCL 03B

A sounding rocket experiment carried two multilayer multianode xenon filled proportional counters and observed the supernova remnants Cas A and Tycho. No evidence for a stable 2 to 10 keV periodic emission from Cas A or Tycho in the period range of .001 to 10.0 seconds was found. Analysis of the spectral data revealed that no single component synchrotron or thermal bremsstrahlung model would adequately represent the data, nor would combinations of these, for both Cas A and Tycho. The main features of the spectra include a steep continuum and a broad emission feature at 7 keV. Synchrotron model fits to the continuum alone are rejected because the spectra would be too steep to have a break by a factor of 1/2 when compared with radio observations and because their intensity at low energies would exceed the extrapolated radio data. To explain the broad emission feature at 7 keV, a model was developed in which supernova ejecta collide with the interstellar gas producing characteristic X-rays via charge exchange and continuum power law X-ray emission via non thermal bremsstrahlung. The explanation provided by this model gives the first direct evidence yet obtained for the emission of subrelativistic energetic nuclei by a supernova. Author

N73-31709*# Scientific Translation Service, Santa Barbara, Calif.
STEADY-STATE FLOW OF THE SOLAR WIND AROUND A DIPOLE
M. L. Brailovskiy and L. S. Frank Washington NASA 10 Sep. 1973 31 p ref Transl. into ENGLISH from Statsionarnoye Obtekaniye Dipolya Solnechnym Vetrom (Moscow), 1971 31 p Previously announced as N72-13754
(Contract NASw-2483)
(NASA-TT-F-15071; PR-77; N72-13754) Avail: NTIS HC $3.75 CSCL 03B

Asymptotic behavior of the magnetic field of a dipole at great distances is considered during solar wind flow about it. A theoretical formula is derived and utilized for interpretation of experimental data on the earth's magnetic field. Author

N73-31710*# Stanford Univ., Calif. Inst. for Plasma Research.
IMPULSIVE SOLAR X-RAY BURSTS: BREMSSTRAHLUNG RADIATION FROM A BEAM OF ELECTRONS IN THE SOLAR CHROMOSPHERE AND THE TOTAL ENERGY OF SOLAR FLARES
Vahe Petrosian Jun. 1973 31 p refs
(Grant NGL-05-020-272)
(NASA-CR-133943; SU-IPR-528) Avail: NTIS HC $3.75 CSCL 03B

Analysis of various aspects of impulsive X-ray bursts (IXB's) has lead to the consideration of a model where the X-rays are produced by bremsstrahlung radiation from a beam of electrons directed toward the photosphere. It was found that in general the X-ray spectrum from such a beam will fall off more rapidly than when the effect of the beaming of radiation is neglected. Furthermore, the spectral index of the resulting X-rays appears to increase by about unity for X-ray energies > 100 kev, a fact which may explain the observed cutoff in the spectrum of the IXB's. It is also shown that in such a model there is sufficient energy in the form of nonthermal electrons to explain the total energy (approximately 10 to the 32nd power ergs) of a flare.
Author

N73-31711*# Washington Univ., St. Louis, Mo. Dept. of Physics.
ISOTOPIC COMPOSITION OF HEAVY COSMIC RAYS
R. C. Maehl, M. H. Israel, and J. Klarmann [1973] 14 p refs
(Grant NGR-26-008-001)
(NASA-CR-135516) Avail: NTIS HC $3.00 CSCL 03B

The mean isotopic composition was measured of even-charge cosmic ray elements with 14 equal to or less than 26 near 0.8 GeV/N using a balloon-borne ionization-chamber/Cerenkov-counter detector system. The experimental method makes use of the geomagnetic field as a magnetic spectrometer. Results indicate that the most abundant isotopes at the cosmic ray source are Si-28, S-32, and Ca-40, like the solar system; but Fe-54, unlike the solar system. Author

N73-31712# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

MODEL FOR THE STEADY STATE INTERACTION OF THE SOLAR WIND WITH THE MOON Ph.D. Thesis

P. J. Catto 1972 129 p refs Previously announced as N73-25845

(Contract AT(30-1)-3943)

(COO-3577-2) Avail: NTIS HC $8.50

The solar wind is a magnetized stream of charged particles emitted continuously by the sun. The steady state interaction of the solar wind with the moon is modeled as a uniform, magnetized, quasi-neutral, collisionless, hypersonic, and hyper-Alfvenic flow of an electron-proton plasma past a perfectly ion absorbing, nonmagnetized sphere. The electron and proton densities and mean velocities are assumed to be equal nearly everywhere. Three different limits of steady state equations are derived from the reduced Vlasov equations and the associated equations of the reduced description by both an ordering scheme that allows for the possibility of different scale lengths along the magnetic field B and along the center of mass velocity, and by an expansion in two small parameters that effectively measure the smallness of gradient B and electron thermal terms compared to a dominant term retained. A technique is presented whereby the three limits can be approximately extended to cases in which the electron thermal terms are comparable or larger than a dominant term retained. Author (NSA)

N73-31713# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

ESTIMATING THE FLARE-PRODUCTION POTENTIAL OF SOLAR ACTIVE REGIONS FROM ANALYSIS OF REAL-TIME MAGNETIC FIELD DATA Environmental Research Papers

David M. Rust 17 Apr. 1973 29 p refs

(AF Proj. 7649)

(AD-762485; AFCRL-TR-73-0221; AFCRL-ERP-440) Avail: NTIS CSCL 03/2

A magnetograph at the Sacramento Peak Observatory is being used on a daily basis to record the magnetic fields in solar active regions. Contour maps of the line-of-sight component of the field are available to the observers and to the flare prediction groups at NOAA and AWS within an hour after observation. The contour maps reveal many details of both weak and strong magnetic fields that are closely associated with large and small flares. Through the use of several examples, empirical rules for estimating flare likelihood are developed. Analysis of the magnetograms shows that flares are probably associated with X-type or Y-type neutral points in the magnetic fields of the solar chromosphere or lower corona. Author (GRA)

N73-31714*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.

A SEARCH FOR SOLAR NEUTRONS FROM 10-100 MeV

Shin Moon and George M. Simnett 29 May 1973 10 p refs

(Grant NGR-05-008-002; Contract N00014-69-A-0200-5001; N00014-69-A-0200-5004; NR Proj. 387-047)

(NASA-CR-135496; AD-763475; IGPP-UCR-73-26; TR-6) Avail: NTIS HC $3.00 CSCL 03/2

A search for solar neutrons is reported from a balloon flight launched from Palestine, Texas on September 26, 1971. The sun was observed from 8:30 to 19:30 CST. The neutrons were detected with a telescope consisting of two 0.5 sq. m. scintillation detectors spaced 1 meter apart using a double scattering-time of flight technique. Upper limits for solar neutrons in the energy intervals 10-30, 30-50, and 50-100 MeV are 1.1 x 10 to the minus 4th power, 2.6 x 10 to the minus 4th power and 5.9 x 10 to the minus 4th power neutrons/sq. cm.-sec respectively. These are combined into an overall upper limit of 5.1 x 10 to the minus 4th power neutrons/sq. cm.-sec.

Author (GRA)

N73-31715*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.

RELATIVISTIC ELECTRON EVENTS IN INTERPLANETARY SPACE

G. M. Simnett Jul. 1973 124 p refs

(Grant NGR-05-008-002; Contract N00014-69-A-0200-5001; N00014-69-A-0200-5004; NR Proj. 387-047)

(NASA-CR-135491; AD-763756; IGPP-UCR-73-12; OTR-7) Avail: NTIS HC 8.25 CSCL 03/2

The review is concerned with relativistic electron events observed in interplanetary space. The different types of event are identified and illustrated. The relationships between solar X-ray and radio emissions and relativistic electrons are examined, and the relevance of the observations to solar flare acceleration models is discussed. A statistical analysis of electron spectra, the electron/proton ratio and propagation from the flare site to the earth is presented. A model is outlined which can account for the release of electrons from the sun in a manner consistent with observations of energetic solar particles and electromagnetic solar radiation. Author (GRA)

N73-31716# Ballistic Research Labs., Aberdeen Proving Ground, Md.

AN ANALYSIS OF SOLAR ILLUMINATED TERRAIN AS A SOURCE OF IRRADIATION IN GROUND TARGET SIGNATURE MODELING

Alan R. Downs Jun. 1973 96 p refs

(DA Proj. 1T0-61102-B-11A)

(AD-763893; BRL-MR-2) Avail: NTIS CSCL 17/5

The sun (moon), sky, and ground can all serve as irradiation sources contributing to a reflective target signature. The absolute and relative magnitudes of the effects of these sources vary widely with the geometric and environmental conditions. The report addresses the manner in which the relative magnitudes of the three effects vary with the parameters of interest for a cloudless daytime sky. To do this, empirical expressions for sky and ground brightness were integrated over the hemisphere contributing to the irradiance incident on a one square cm target and compared to the solar contributions. This comparison was made for a number of geometric configurations, for visibilities between 5 and 50 kilometers, for wavelengths between 0.425 and 1.625 micrometers, and for grassy and sandy terrains. The results are presented in tabular form. A discussion of error sources is also included. Author (GRA)

N73-31717# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.

SEARCH FOR SOLAR RECOMBINATION LINES IN THE FREQUENCY RANGE 110-115 GHZ Rept for Jan. - Dec. 1972

Fred I. Shimabukuro and William J. Wilson 15 Apr. 1973 17 p refs

(Contract F04701-72-C-0073)

(AD-763719; TR-0073(9230-30)-6; SAMSO-TR-73-214) Avail: NTIS CSCL 03/2

A search for solar recombination lines in active regions was made in the frequency range 110-115 GHz. The results, which were negative, are presented. An upper limit of T(l)/T(chr) approximately 10 to the minus 3rd power is given for the intensity ratio of the line to the continuum chromospheric emission.

Author (GRA)

N73-31863* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PROBABILITIES FOR THE PEAK FLUX AND FLUENCE OF ENERGETIC SOLAR PROTONS INCIDENT ON INTERPLANETARY SPACECRAFT

N. Divine *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 37-44 refs (For availability see N73-31858 22-34)

CSCL 03B

N73-31869* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POSITRON ANNIHILATION RADIATION FROM NEUTRON STARS

Gerhard A. Borner *In its* Significant Accomplishments in Sci. 1973 p 9-11 (For availability see N73-31867 22-34)

CSCL 03B

N73-31871* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ATMOSPHERIC SECONDARY GAMMA RADIATION

David J. Thompson *In its* Significant Accomplishments in Sci. 1973 p 16-19 (For availability see N73-31867 22-34)

CSCL 03B

N73-31872* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRIMARY AND SECONDARY NUCLEI IN HIGH-ENERGY COSMIC RAYS
Jonathan F. Ormes *In its* Significant Accomplishments in Sci. 1973 p 20-23 (For availability see N73-31867 22-34)
CSCL 03B

N73-31873* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROGRESS IN THE MEASUREMENT OF HIGH-ENERGY GALACTIC COSMIC RAY ELECTRONS
Robert F. Silverberg *In its* Significant Accomplishments in Sci. 1973 p 24-28 (For availability see N73-31867 22-34)
CSCL 03B

N73-31874* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FIRST INTEGRATED INTERPLANETARY ELECTRON SPECTRUM
Thomas L. Cline *In its* Significant Accomplishments in Sci. 1973 p 29-33 (For availability see N73-31867 22-34)
CSCL 03B

N73-31875* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODULATION OF LOW-ENERGY GALACTIC COSMIC RAYS OVER THE PRESENT SOLAR CYCLE
Michele A. VanHollebeke *In its* Significant Accomplishments in Sci. 1973 p 34-37 (For availability see N73-31867 22-34)
CSCL 03B

N73-31876* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF SOLAR COSMIC RAYS AT 2 AU
James H. Trainor *In its* Significant Accomplishments in Sci. 1973 p 38-44 (For availability see N73-31867 22-34)
CSCL 03B

N73-31877* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIAL GRADIENTS OF GALACTIC COSMIC RAY PROTONS AND HELIUM NUCLEI
Bonnard J. Teegarden *In its* Significant Accomplishments in Sci. 1973 p 45-48 (For availability see N73-31867 22-34)
CSCL 03B

N73-31878* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR FLARE PRODUCED PULSATIONS IN METER AND X-RAY WAVELENGTHS
Kenneth J. Frost *In its* Significant Accomplishments in Sci. 1973 p 49-53 refs (For availability see N73-31867 22-34)
CSCL 03B

N73-31879* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPATIAL STRUCTURE OF A TWO-PHASE SOLAR FLARE OBSERVED IN THE EUV BY OSO-7
Roger J. Thomas *In its* Significant Accomplishments in Sci. 1973 p 54-57 (For availability see N73-31867 22-34)
CSCL 03B

N73-31880* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GROUND-BASED FLARE STUDIES AT SACRAMENTO PEAK
Stephen P. Maran *In its* Significant Accomplishments in Sci. 1973 p 58-62 (For availability see N73-31867 22-34)
CSCL 03B

N73-31881* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STUDY OF SOLAR FLARES DURING THE NEXT SUNSPOT MAXIMUM
John C. Brandt *In its* Significant Accomplishments in Sci. 1973 p 63-68 (For availability see N73-31867 22-34)
CSCL 03B

N73-31887* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW-INTENSITY OPTICAL EMISSIONS FROM THE INTERSTELLAR MEDIUM
Ronald J. Reynolds *In its* Significant Accomplishments in Sci. 1973 p 88-91 (For availability see N73-31867 22-34)
CSCL 03B

N73-31894* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO ORBITAL GEOCHEMISTRY: X-RAYS
Isidore Adler *In its* Significant Accomplishments in Sci. 1973 p 127-131 (For availability see N73-31867 22-34)
CSCL 03B

N73-31895* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO ORBITAL GEOCHEMISTRY: GAMMA RAYS
Jacob I. Trombka *In its* Significant Accomplishments in Sci. 1973 p 132-135 (For availability see N73-31867 22-34)
CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-31718 Ohio State Univ., Columbus.
A SPECTROSCOPIC STUDY OF GALACTIC NUCLEI Ph.D. Thesis
John Ward Warner, III 1972 126 p
Avail: Univ. Microfilms Order No. 73-11602

The scope of activity in the nuclei of normal galaxies and its relation to more energetic objects like quasi-stellar sources has provoked considerable interest in recent years, yet few galaxies have been studied in any detail since adequate instrumentation has not been available. Several nearby objects (M51, M81, NGC 5195) are singled out for a detailed study of their inner nuclei using image tube spectrographic techniques. Widened spectra are obtained using a sky-light suppressor on the slit of the spectrograph and various slot sizes. Line strengths are shown to vary as a function of distance from the nucleus with (NII) lambda 6584/H alpha changing by an order of magnitude in M51. For M51 and M81 physical conditions are calculated and compared for concentric regions surrounding the nucleus, and it is shown that there is a density gradient in the ionized gas going into the nucleus. Dissert. Abstr.

N73-31719 New Mexico State Univ., University Park.
OBSERVATIONS OF ATMOSPHERE LIMB DARKENING IN THE VISUAL CONTINUUM AND AN ANALYSIS OF MULTIPLE SCATTERING IN THE ATMOSPHERES OF JUPITER AND SATURN Ph.D. Thesis
Bradford A. Smith 1972 180 p
Avail: Univ. Microfilms Order No. 73-10372

Atmospheric limb darkening of optically homogeneous belts and zones on Jupiter and Saturn was measured in the visual continuum over a range of spectral passbands and phase angles for the years 1969 and 1971. Both Jupiter and Saturn exhibit surface brightness distributions that are consistent with anisotropic scattering in a semi-infinite cloud layer, but the observations also suggest the presence of an optically thin layer of small particles overlying the dense cloud surface on Saturn. The shape of the scattering indicatrix of particles in the Jovian cloud surface in 1971 varied only slightly from place to place and, in general, indicated slightly forward scattering. The observed variations were unrelated to color or albedo. In the shorter wavelengths only, the cloud particles in both the Northern and Southern Hemispheres of Jupiter in 1969 showed backscattering characteristics. On Saturn in 1970 all observable regions of the Southern Hemisphere indicated rather strong backscattering properties. Dissert. Abstr.

N73-31720 Maryland Univ., College Park.
THERMAL STABILITY IN PLANETARY NEBULAE Ph.D. Thesis
John George Lyon 1972 122 p
Avail: Univ. Microfilms Order No. 73-11403

Field's (1965) thermal stability citeria are extended to media in which (1) one atomic component is not required to be in ionization equilibrium and (2) in which there are gradients in the initial conditions. In (1) the condition for condensation is unchanged, but overstable sound waves are possible for situations that are stable by Field's isentropic condition. The overstability is driven by the lag in ionization level as compared to the density, say, in the sound wave. The maximum level of ionization occurs after the density minimum. Situation (2) is studied in the eikonal (WKBJ) approximation. The condensation criterion is unchanged as long the local growth or damping rate for this mode is much faster than the rate at which a fluid element is carried by the bulk velocity across a scale height. The gradients introduce a convective mode whose behavior is closely linked to the initial bulk velocity. Dissert. Abstr.

N73-31721 Wayne State Univ., Detroit, Mich.
DOPPLER SHIFTS DUE TO EXTREME RELATIVISTIC ROTATION Ph.D. Thesis
Shing-lung Su 1972 121 p
Avail: Univ. Microfilms Order No. 73-12605

The general problem of determining the Doppler shift arising from a radiating body rotating at extreme relativistic speeds is investigated. The theory is established, and a solution is found for the case of a (rest frame) delta function line shape. The general effect is to strongly blue shift the line but which leaves the total integrated intensity unchanged. Also discussed are the spherically symmetric problem with the Breit-Wigner formula line shape and with black-body radiation, both of which are solved by computer techniques. The most general case that is solved analytically (for the delta function line shape) is that of an ellipsoid of revolution rotating about its symmetry axis, but with the observer having random orientation with respect to that axis. Sample results are given for this special case. The problem is then solved by computer techniques for more realistic line shapes and for continuous spectrum. The limb darkening and the gravitational red shift are taken into account at this time.
Dissert. Abstr.

N73-31722 Ohio State Univ., Columbus.
NEAR INFRARED PHOTOMETRY AND ABSOLUTE MAGNITUDES OF CARBON STARS Ph.D. Thesis
John Henry Baumert 1972 274 p
Avail: Univ. Microfilms Order No. 73-11449

A large sample of carbon stars, barium stars, CH stars, and hydrogen deficient carbon stars have been observed in the near infrared from 7100 A to 11,000 A with eight narrow-band interference filters. An important advantage of the eight-color system is the simultaneous measurement of the infrared I(104) magnitude, the color temperature and the absolute band strength of the CN molecule. Since nearly all of the observed stars have a measured radial velocity and/or proper motion, it is possible to apply statistical techniques to derive a mean parallax and an absolute magnitude M(104) at 1.04 microns. The stars were divided into twenty-two groups (not mutually exclusive) based on spectral characteristics, variability types, or a combination of the two. For each group parallaxes were obtained from the nu components of the proper motion, from the tau components, and from the nw residuals. Dissert. Abstr.

N73-31723*# Analytical Mechanics Associates, Inc., Seabrook, Md.
TETHERED BODY PROBLEMS AND RELATIVE MOTION ORBIT DETERMINATION Final Report
J. B. Eades, Jr. and Henry Wolf Aug. 1972 316 p refs
(Contract NAS5-21453)
(NASA-CR-132780; Rept-72-35) Avail: NTIS HC $18.00 CSCL 22A

Selected problems dealing with orbiting tethered body systems have been studied. In addition, a relative motion orbit determination program was developed. Results from these tasks are described and discussed. The expected tethered body motions were examined, analytically, to ascertain what influence would be played by the physical parameters of the tether, the gravity gradient and orbit eccentricity. After separating the motion modes these influences were determined; and, subsequently, the effects of oscillations and/or rotations, on tether force, were described. A study was undertaken, by examining tether motions, to see what type of control actions would be needed to accurately place a mass particle at a prescribed position relative to a main vehicle. Other applications for tethers were studied. Principally these were concerned with the producing of low-level gee forces by means of stabilized tether configurations; and, the initiation of free transfer trajectories from tether supported vehicle relative positions. Author

N73-31724# Specola Vaticana (Vatican City).
ANNUAL REPORT OF THE VATICAN OBSERVATORY, 1972
1972 19 p Original contains color illustrations
Avail: NTIS HC $3.00

The history, organization, and functions of the Vatican astronomical observatory are presented. The subjects discussed are: (1) geographic situation and climate, (2) telescopes, (3) auxiliary equipment, (4) computing equipment, and (5) research projects. Author

N73-31725*# Modern Systems Analysis, Inc., Ann Arbor, Mich.
NUMERICAL INTEGRATION ROUTINES FOR NEAR-EARTH OPERATIONS Final Report
William F. Powers Sep. 1973 79 p refs
(Contract NAS9-12319)
(NASA-CR-134021; Rept-9-12319-73F) Avail: NTIS HC $6.00 CSCL 22A

Two general purpose numerical integration schemes were built into the NASA-JSC computer system. The state-of-the-art of numerical integration, the particular integrators built into the JSC computer system, and the use of the new integration packages are described. Background information about numerical integration and the variable-order, variable-stepsize Adams numerical integration technique is discussed. Results concerning the PEACE parameter optimization program are given along with recommendations and conclusions. Author

N73-31726*# North American Rockwell Corp., Downey, Calif. Space Div.
SAFETY IN EARTH ORBIT STUDY Final Report (contract summary)
12 Jul. 1972 26 p refs
(Contract NAS9-12004)
(NASA-CR-134023; SD-72-SA-0095; MSC-04478) Avail: NTIS HC $3.50 CSCL 22C

Safety aspects are studied of the space shuttle orbiter, the shuttle payloads, and space stations in earth orbital operations. The tasks generated safety requirements, guidelines, recommendations, and conceptual safety devices. The tasks studied were: hazardous payloads, docking, onboard survivabiliy tumbling spacecraft, and escape and rescue operations. T.M.R.

N73-31727*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUMMARY OF SATURN SWINGBY MISSIONS TO URANUS
Larry A. Manning Washington Sep. 1973 23 p refs
(NASA-TM-X-2914; A-5001) Avail: NTIS HC $2.75 CSCL 22C

The interplanetary trajectory characteristics for missions to Uranus, which employ an intermediate swingby of Saturn to reduce the total trip time are summarized. Opportunities for such swingby missions will occur from 1979 through 1987 and not again until 2025. The general trajectory characteristics (C sub 3; departure, swingby, and arrival dates; swingby radius; and arrival speed) are evaluated, and payload and launch window information for a Titan 3E/Centaur/TE-364-4 class launch vehicle is provided. Author

N73-31728*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PRELIMINARY ANALYSIS OF A RADAR-MAPPING MISSION TO VENUS

John S. MacKay, Larry E. Edsinger, Lawrence C. Evans, Larry A. Manning, Kenneth F. Sinclair, and Bryon L. Swenson Washington Sep. 1973 69 p refs
(NASA-TM-X-2868; A-4834) Avail: NTIS HC $3.50 CSCL 22A

A rather broad survey is reported of the Venus radar orbiter possibilities within the period 1983-1990. Minimum mission imaging requirements have been set by comparison with the improving capabilities of earth based radar systems and an examination of earth airborne radar imaging. This has led to a requirement for 80 percent coverage at a resolution of 100 m. A first main conclusion is that only the Shuttle-Centaur launch system would be capable of establishing a circular orbit under all possible launch conditions. Thus, orbit eccentricity has been introduced as a parameter throughout this presentation. An examination of typical radar designs has led to upper and lower limits on swath width of 100 and 50 km. A lower eccentricity of 0.2 was set by considering the current Viking propulsion system. An examination of solar perturbations indicates that orbit maintenance problems increase rapidly above an eccentricity of 0.5. Author

N73-31729*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF AIRBORNE SCIENCE EXPERIMENT MANAGEMENT CONCEPTS FOR APPLICATION TO SPACE SHUTTLE, VOLUME 2
Donald R. Mulholland, John O. Reller, Jr., Carr B. Neel, and Louis C. Haughney Jul. 1973 132 p refs
(NASA-TM-X-62287) Avail: NTIS HC $8.75 CSCL 22A

Airborne research management and shuttle sortie planning at the Ames Research Center are reported. Topics discussed include: basic criteria and procedures for the formulation and approval of airborne missions; ASO management structure and procedures; experiment design, development, and testing aircraft characteristics and experiment interfaces; information handling for airborne science missions; mission documentation requirements; and airborne science methods and shuttle sortie planning. F.O.S.

N73-31730*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Aero-Astrodynamics Lab.
OPTIMUM INCLINATION FOR SHUTTLE RETRIEVAL OF INCLINATION NON-SENSITIVE SATELLITES
Douglas L. Blackwell Aug. 1973 18 p refs
(NASA-TM-X-64780) Avail: NTIS HC $3.00 CSCL 22A

A study to identify the optimum inclination for a satellite when the satellite is inclination non-sensitive and is to be retrieved is reported. This inclination is such that it provides an opportunity for a retrieval flight at least once each day with minimal on-orbit phasing requirements and minimal ascent performance losses. Author

N73-31731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GUM NEBULA AND RELATED PROBLEMS
Washington 1973 246 p refs Symp. held at Greenbelt, Md., 18 May 1971
(NASA-SP-332) Avail: NTIS HC $5.75 CSCL 03A

Proceedings of a symposium concerning the Gum Nebula (GN) and related topics are reported. Papers presented include: Colin Gum and the discovery of the GN; identification of the GN as the fossil Stromgren sphere of Vela X Supernova; size and shape of GN; formation of giant H-2 regions following supernova explosions; radio astronomy Explorer 1 observations of GN; cosmic ray effects in the GN; low intensity H beta emission from the interstellar medium; and how to recognize and analyze GN. Astronomical charts and diagrams are included. K.M.M.

N73-31732*# Scripta Technica, Inc., Washington, D.C.
PROSPECTIVE EXTRA-ATMOSPHERIC ASTRONOMICAL INVESTIGATIONS
V. G. Kurt NASA Sep. 1973 17 p Transl. into ENGLISH from Priroda (Moscow), no. 5, 1973 p 15-19
(Contract NASw-2484)
(NASA-TT-F-15119) Avail: NTIS HC $3.00 CSCL 03A

The advantages of extra-atmospheric telescopes over terrestrial telescopes are outlined. An enumeration of the requirements of extra-atmospheric telescopes is given and the significance of extra-atmospheric astronomy with respect to the future of astronomical research is emphasized. Precise measurements on the capacities of existing instruments are reported. Author •9

N73-31733*# Martin Marietta Corp., Denver, Colo.
STUDY OF BALLISTIC MODE MERCURY ORBITER MISSIONS. VOLUME 1: SUMMARY REPORT
G. R. Hollenbeck Jul. 1973 25 p
(Contract NAS2-7268)
(NASA-CR-114617) Avail: NTIS HC $3.25 CSCL 22C

A summary is given of the scope, approach, and major results of the study of ballistic mode Mercury orbit missions (the Mariner Venus-Mercury spacecraft). The performance potential of ballistic flight mode is presented along with a study of alternate flight techniques. Orbit selection considerations are discussed in terms of the thermal environment of Mercury. Orbiter science experiments are summarized. Technology assessments were conducted for major subsystems appropriate to spin-stabilized and three-axis-stabilized spacecraft designs. Conclusions from this study are: ballistic mode Mercury orbiter missions offer adequate performance for effective follow-up of the MVM'73 science findings; the existing and programmed technology base is adequate for implementation of Mercury orbit spacecraft design; and when pending MVM flyby has been accomplished and the results analyzed, the data base will be adequate to support detailed orbiter spacecraft design efforts. K.M.M.

N73-31734*# Martin Marietta Corp., Denver, Colo.
STUDY OF BALLISTIC MODE MERCURY ORBITER MISSIONS. VOLUME 2: TECHNICAL REPORT
W. S. Cook, G. R. Hollenbeck, P. S. Lewis, D. G. Roos, and D. E. Wainwright Jul. 1973 178 p refs
(Contract NAS2-7268)
(NASA-CR-114618) Avail: NTIS HC $11.00 CSCL 22C
For abstract, see N73-31733.

N73-31735*# Martin Marietta Corp., Denver, Colo.
A STUDY OF AN ORBITAL RADAR MAPPING MISSION TO VENUS. VOLUME 1: SUMMARY Final Report
Sep. 1973 38 p 3 Vol.
(Contract NAS2-7204)
(NASA-CR-114640) Avail: NTIS HC $4.00 CSCL 22A

A preliminary design of a Venus radar mapping orbiter mission and spacecraft was developed. The important technological problems were identified and evaluated. The study was primarily concerned with trading off alternate ways of implementing the mission and examining the most attractive concepts in order to assess technology requirements. Compatible groupings of mission and spacecraft parameters were analyzed by examining the interaction of their functioning elements and assessing their overall cost effectiveness in performing the mission. Author

N73-31736*# Martin Marietta Corp., Denver, Colo.
A STUDY OF AN ORBITAL RADAR MAPPING MISSION TO VENUS. VOLUME 2: CONFIGURATION COMPARISONS AND SYSTEMS EVALUATION Final Report
Sep. 1973 283 p refs 3 Vol.
(Contract NAS2-7204)
(NASA-CR-114641) Avail: NTIS HC $16.25 CSCL 22A

Configuration comparisons and systems evaluation for the orbital-radar mapping mission of the planet Venus are discussed. Designs are recommended which best satisfy the science objectives of the Venus radar mapping concept. Attention is given to the interaction and integration of those specific mission-systems recommendations with one another, and the final proposed designs are presented. The feasibility, cost, and scheduling of these configurations are evaluated against assumptions of reasonable state-of-the-art growth and space funding expectations. Author

N73-31737*# Martin Marietta Corp., Denver, Colo.
A STUDY OF AN ORBITAL RADAR MAPPING MISSION TO VENUS. VOLUME 3: PARAMETRIC STUDIES AND SUBSYSTEM COMPARISONS Final Report

Sep. 1973 498 p refs 3 Vol.
(Contract NAS2-7204)
(NASA-CR-114642) Avail: NTIS HC $27.00 CSCL 22A

Parametric studies and subsystem comparisons for the orbital radar mapping mission to planet Venus are presented. Launch vehicle requirements and primary orbiter propulsion system requirements are evaluated. The systems parametric analysis indicated that orbit size and orientation interrelated with almost all of the principal spacecraft systems and influenced significantly the definition of orbit insertion propulsion requirements, weight in orbit capability, radar system design, and mapping strategy.
Author

N73-31738# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 307
31 Aug. 1973 113 p refs Transl. into ENGLISH from various Soviet Bloc periodicals
(JPRS-59935) Avail: NTIS HC $7.75

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included.
Author

N73-31739*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECHNIQUES FOR THE ANALYSIS OF GEODYNAMIC EFFECTS USING LASER DATA
Peter J. Dunn, David E. Smith, and Ronald Kolenkiewicz May 1973 14 p refs Submitted for publication
(NASA-TM-X-70459; X-592-73-235) Avail: NTIS HC $3.00 CSCL 22C

New orbit computation techniques have been developed to realize the full precision of laser ranging measurements from a single tracking station used to accurately determine the orbital inclination of a satellite. In order to evaluate earth and ocean tidal effects on the satellite and polar motion effects on the station latitude, improved computational techniques are described for perturbations significantly influencing the satellite's inclination, such as solar radiation pressure and geopotential resonance. By using the time independent value of maximum latitude reached by the satellite as the experimental variable, orbit tracking errors caused by imprecise modelling of the gravity field and atmospheric drag have been largely overcome and made possible long term analysis of osculating elements. With these techniques, quarter day spans of laser data have been employed to monitor the inclination of the satellite to the order 0.01 arcseconds precision over a period of seventeen months.
Author

N73-31740# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 308
14 Sep. 1973 93 p refs Transl. into ENGLISH from various Soviet bloc periodicals
(JPRS-60035) Avail: NTIS HC $6.75

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports.
Author

N73-31741*# Kanner (Leo) Associates, Redwood City, Calif.
DOCKING TECHNOLOGY
Washington NASA Sep. 1973 14 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 4, 1973 p 7-13
(Contract NASw-2481)
(NASA-TT-F-15105) Avail: NTIS HC $3.00 CSCL 22C

One of the important achievements of space technology is the solution of the problem of orbital docking. Described in detail are two docking methods: the probe-cone method and the androgenic method. Diagrams of the probe-cone mechanism utilized for docking Soyuz-11 and the Salyut space station are included and the androgenic mechanism being developed for the Apollo-Soyuz joint space flight is developed. In addition, there are sketches illustrating spaceship rendezvous and docking in space and transfer of astronauts from one ship to the other.
Author

N73-31742*# Techtran Corp., Glen Burnie, Md.
NEW FACTS CONCERNING THE COMPOSITION OF THE TUNGUS METEORITE
N. V. Vasilyev, G. M. Ivanova, and Yu. A. Lvov Washington NASA Sep. 1973 7 p ref Transl. into ENGLISH from Priroda (Moscow), no. 7, Jul. 1973 p 99-101
(Contract NASw-2485)
(NASA-TT-F-15125) Avail: NTIS HC $3.00 CSCL 03B

Recent studies of the peat bogs in the area where the Tungus meteorite fell have led to the discovery of small hollow spherules of glass containing various gases. Most of these spherules are associated with the peat layer representing the year 1908, in which the famous meteorite fell. Although most of these glass spheres are felt to be of terrestrial origin, caused by the peat fires ignited by the meteorite's fall, the search for similar objects of extraterrestrial origin is going forward.
Author

N73-31743*# Scientific Translation Service, Santa Barbara, Calif.
THE PLASMA IN THE VICINITY OF VENUS. COMPARISON OF THE RESULTS RECEIVED BY MEANS OF VENERA-4 AND MARINER-5
T. K. Breus and K. I. Gringauz Washington NASA 29 Sep. 1973 11 p refs Transl. into ENGLISH from the publ. "Physics of the Moon and the Planets" Moscow, Nauka, 1972 p 279-283
(Contract NASw-2483)
(NASA-TT-F-15128) Avail: NTIS HC $3.00 CSCL 03B

The results obtained by Venera-4 and Mariner-5 in the vicinity of Venus are compared. Plasma and magnetic field measurements close to the planet indicate that there was a synchronous change in the parameters characterizing the plasma and the magnetic field.
Author

N73-31744*# Techtran Corp., Silver Spring, Md.
PRELIMINARY DATA ON THE LUNAR SOIL BROUGHT BACK BY THE LUNA-20 AUTOMATIC STATION
A. P. Vingradov Washington NASA Sep. 1973 19 p Transl. into ENGLISH from Priroda (USSR), no. 8, Aug. 1972 p 2-10
(Contract NASw-2485)
(NASA-TT-F-15100) Avail: NTIS HC $3.00 CSCL 03B

A comparison of the lunar material of Luna-20 with material derived from other lunar probes is reported. Differences and some contradictions found among the varying chemical compositions of lunar materials from the different lunar probes are discussed. It is concluded that the lunar anorthosites as well as the terrestrial anorthosites should become the object of further long term research to determine their origin and age.
Author

N73-31745*# Kanner (Leo) Associates, Redwood City, Calif.
THE STRATEGY OF SPACE RESEARCH
H. Alfven Washington NASA Sep. 1973 11 p Transl. into ENGLISH from Strategiya Kosmich. Issled. (USSR), no. 7, Jul. 1972 p 11-14
(Contract NASw-2481)
(NASA-TT-F-15120) Avail: NTIS HC $3.00 CSCL 22A

The inadequacy of chemical-fuel rocket engines and the need for new energy sources are discussed, in particular, the tapping of the cosmic plasma and the extracting of energy from the solar wind is suggested. The social value of space research and the importance of space flights in any attempt to solve the cosmological problem are stressed. Flights to the asteroids and comets are considered to be as important as flights to the planets.
Author

N73-31746*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND TUNNEL STUDIES OF MARTIAN AEOLIAN PROCESSES
Ronald Greeley (Santa Clara Univ.), James D. Iversen (Iowa State Univ. of Sci. and Technol.), James B. Pollack, Nancy Udovich (Santa Clara Univ.), and Bruce White (Iowa State Univ. of Sci. and Technol.) May 1973 70 p refs
(NASA-TM-X-62297) Avail: NTIS HC $5.50 CSCL 03B

Preliminary results are reported of an investigation which

involves wind tunnel simulations, geologic field studies, theoretical model studies, and analyses of Mariner 9 imagery. Threshold speed experiments were conducted for particles ranging in specific gravity from 1.3 to 11.35 and diameter from 10.2 micron to 1290 micron to verify and better define Bagnold's (1941) expressions for grain movement, particularly for low particle Reynolds numbers and to study the effects of aerodynamic lift and surface roughness. Wind tunnel simulations were conducted to determine the flow field over raised rim craters and associated zones of deposition and erosion. A horseshoe vortex forms around the crater, resulting in two axial velocity maxima in the lee of the crater which cause a zone of preferential erosion in the wake of the crater. Reverse flow direction occurs on the floor of the crater. The result is a distinct pattern of erosion and deposition which is similar to some martian craters and which indicates that some dark zones around Martian craters are erosional and some light zones are depositional. Author

N73-31747*# National Aeronautics and Space Administration, Washington, D.C.
THE 1973 REPORT AND RECOMMENDATIONS OF THE NASA SCIENCE ADVISORY COMMITTEE ON COMETS AND ASTEROIDS
Ken Atkins, ed (JPL) [1973] 73 p refs
(NASA-TM-X-71917) Avail: NTIS HC $5.75 CSCL 03B

The present day knowledge is reported of comets and asteroids and recommendations for a development program needed to provide instruments to achieve certain scientific objectives are also presented. Discussions include reports on the primary experiments and instruments, the instruments of potential applicability, mission classes and parameters, mission opportunities, and vehicular technology. An annotated bibliography and recommendations for flight projects, propulsion systems, and experiment development are included. T.M.R.

N73-31748# Michigan Univ., Ann Arbor.
FOURTH LIST OF STARS OBSERVED AT THE LAMONT-HUSSEY OBSERVATORY Publications of the Observatory of the University of Michigan, volume 12, no. 1
Frank Holden Mar. 1972 18 p refs Supported by NSF
Avail: NTIS HC $3.00

A listing of double star observations for 1900 and 1960 are presented. Information is given for: number of the pair in Rossiter's Catalogue of Southern Double Stars (R.D.S.); an alternative designation, to assist identification; the coordinates for 1900, in accordance with R.D.S.; the epoch of the observations; the mean position-angle and separation of the stars; the mean estimated difference of magnitude observed; and remarks. A listing of stars not included in Rossiter's Catalogue is also presented along with newly discovered pairs encountered during the remeasuring. Author

N73-31749*# Techtran Corp., Glen Burnie, Md.
WHERE AND WHEN DID BORODINO METEORITE FALL?
A. A. Yavnel Washington NASA Sep. 1973 5 p refs Transl. into ENGLISH from Priroda (Moscow), no. 7, Jul. 1973 p 102-103
(NASA-TT-F-15126) Avail: NTIS HC $3.00 CSCL 03B

A clarification is presented of details surrounding the discovery of the so-called Borodino meteorite. It is concluded that, judging by the nature of its composition, this meteorite could not have been a portion of any known fall of meteoritic rain. Author

N73-31750*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 15 MISSION REPORT, SUPPLEMENT 4: DESCENT PROPULSION SYSTEM FINAL FLIGHT EVALUATION
A. T. Avvenire and S. C. Wood Sep. 1972 81 p Prepared by TRW Systems Group, Houston
(Contract NAS9-12330)
(NASA-TM-X-69506; MSC-05161-Suppl-4; TRW-20029-H084-R0-00-Suppl-4) Avail: NTIS HC $6.25 CSCL 22C

The results of a postflight analysis of the LM-10 Descent Propulsion System (DPS) during the Apollo 15 Mission are reported. The analysis determined the steady state performance of the DPS during the descent phase of the manned lunar landing. Flight measurement discrepancies are discussed. Simulated throttle performance results are cited along with overall performance results. Evaluations of the propellant quantity gaging system, propellant loading, pressurization system, and engine are reported. Graphic illustrations of the evaluations are included. K.M.M.

N73-31751*# TRW Systems, Redondo Beach, Calif.
MISSION REQUIREMENTS FOR A MANNED EARTH OBSERVATORY. VOLUME 1, TASK 1: EXPERIMENT SELECTION, DEFINITION, AND DOCUMENTATION
31 May 1973 347 p refs
(Contract NAS8-28013)
(NASA-CR-124368; TRW-21324-6001-RU-00) Avail: NTIS HC $19.50 CSCL 22A

Information related to proposed earth observation experiments for shuttle sortie missions (SSM) in the 1980's is presented. The step-wise progression of study activities and the development of the rationale that led to the identification, selection, and description of earth observation experiments for SSM are listed. The selected experiments are described, defined, and documented by individual disciplines. These disciplines include: oceanography; meteorology; agriculture, forestry, and rangeland; geology; hydrology; and environmental impact. K.M.M.

N73-31752*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
SPACE PROCESSES FOR EXTENDED LOW-G TESTING Final Report
W. H. Steurer, S. Kaye, and D. J. Gorham 15 Jun. 1973 374 p
(Contract NAS8-28615)
(NASA-CR-124385; CASD-STT-73-005) Avail: NTIS HC $20.75 CSCL 22C

Results of an investigation of verifying the capabilities of space processes in ground based experiments at low-g periods are presented. Limited time experiments were conducted with the processes. A valid representation of the complete process cycle was achieved at low-g periods ranging from 40 to 390 seconds. A minimum equipment inventory, is defined. A modular equipment design, adopted to assure low cost and high program flexibility, is presented as well as procedures and data established for the synthesis and definition of dedicated and mixed rocket payloads. Author

N73-31753*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
INVESTIGATION OF ULTRAVIOLET INTERSTELLAR EXTINCTION Final Report, 1 Oct. 1972 - 30 Jun. 1973
Cecilia Payne and Katherine L. Haramundanis Jun. 1973 30 p refs
(Grant NGR-09-015-200)
(NASA-CR-133924; SAO-307-047) Avail: NTIS HC $3.50 CSCL 03A

Results concerning interstellar extinction in the ultraviolet are reported. These results were initially obtained by using data from main-sequence stars and were extended to include supergiants and emission stars. The principal finding of the analysis of ultraviolet extinction is not only that it is wavelength dependent, but that if changes with galactic longitude in the U3 passband (lambda sub eff = 1621 A); it does not change significantly in the U2 passband (lambda sub eff = 2308 A). Where data are available in the U4 passband (lambda sub eff = 1537 A), they confirm the rapid rise of extinction in the ultraviolet found by other investigators. However, in all cases, emission stars must be used with great caution. It is important to realize that while extinction continues to rise toward shorter wavelengths in the ultraviolet, including the shortest ultraviolet wavelengths measured (1100 A), it no longer plays an important role in the X-ray region (50 A). Author

N73-31754*# California Inst. of Tech., Pasadena.
RELATIVISTIC STELLAR STABILITY: PREFERRED-FRAME EFFECTS
Wei-Tou Ni 1973 15 p refs Prepared in cooperation with Mont. State Univ., Bozeman
(Grant NGR-05-002-256; NGR-27-001-035; NSF GP-36687X; NSF GP-28027)
(NASA-CR-135517) Avail: NTIS HC $3.00 CSCL 03A

Possible preferred-frame effects on stellar stability were examined and no new instabilities were found. In particular, it is shown that: (1) Although terms linear in the preferred-frame velocity w (time-odd terms, analogous to viscosity and energy generation) change the shapes of the normal modes, their symmetry properties prevent them from changing the characteristic frequencies. Thus, no new vibrational or secular instabilities can occur. (2) Terms quadratic in w do not change either the shapes of the normal modes or the characteristic frequencies for radial pulsations. Thus, they have no influence on radial stability. (3) Terms quadratic in w do change both the normal modes and the characteristic frequencies of nonradial pulsations; but in the limit of a neutral mode these changes vanish. Hence, there is no modification of the criterion for convective stability, i.e., the standard Schwarzschild criterion remains valid. Author

N73-31755*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
FUNDAMENTAL DATA FOR CONTACT BINARIES: RZ COMAE, RZ TAURI, AND AW UMA
Robert E. Wilson and Edward J. Devinney (Univ. of South Fla.) [1972] 20 p refs
(Grant NSF GP-18181)
(NASA-TM-X-69614) Avail: NTIS HC $3.00 CSCL 03A

Differential corrections analyses of three W UMa type binaries show that RZ Tau and AW UMa have common envelopes and the relatively small gravity darkening predicted by Lucy, while RZ Comae seems to have a larger gravity effect and is only marginally in contact. Some details of the method for computing contact binary light curves are given. It is suggested that W UMa binaries which have occultation primary eclipses may, in general, have large amplitudes for gravity darkening or a photometric surface brightness effect which simulates large gravity darkening. Author

N73-31756*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NONDESTRUCTIVE DETERMINATION OF RADIONUCLIDES IN LUNAR SAMPLES USING A LARGE LOW-BACKGROUND GAMMA-RAY SPECTROMETER AND A NOVEL APPLICATION OF LEAST-SQUARES FITTING
J. S. Eldridge, G. D. Okelly, K. J. Northcutt, and E. Schonfeld [1972] 8 p Prepared in cooperation with ORNL
(NASA-TM-X-69581; Conf-720824-1) Avail: NTIS HC $3.00

Dual-parameter gamma ray spectrometer systems with large volume NaI (Tl) crystals and low backgrounds were used for nondestructive determination of K, Th, U and cosmic ray produced radionuclides in 60 lunar samples. The total weight of samples measured with this system is 28 kg, and the individual sample weights varied from 2 to 2300 g. Samples from Apollo 11, 12, 14, 15 and 16 were measured. Operation of the spectrometers in the coincidence mode and analyzing single coincidence spectra permits the simultaneous determination of 8-10 radionuclides in each lunar sample. Author

N73-31757# Technische Hochschule, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
PRELIMINARY ORBIT DETERMINATION OF ARTIFICIAL EARTH SATELLITES [ZUR VORLAEUFIGEN BAHNBESTIMMUNG KUENSTLICHER ERDSATELLITEN]
Karl Heinz Ilk Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. May 1972 105 p refs In GERMAN; ENGLISH summary
(Contract WRK-132; SFB-78)
(BMBW-FB-W-72-16) Avail: NTIS HC $7.25; ZLDI, Munich 21,70 DM

A computer program was written for a preliminary orbit determination of artificial earth satellites using HAMMERSTEIN's method for solving nonlinear integral equations. The program can use photographic and distance measurements to compute short arcs of the length of half an orbit. The computations are based on an inertial reference system. Author (ESRO)

N73-31758# Technische Hochschule, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
DETERMINATION OF PROBLEMS OF MOTION BY TEMPORAL BOUNDARY VALUES [DETERMINIERUNG VON BEWEGUNGSPROBLEMEN DURCH ZEITLICHE RANDWERTE]
Manfred Schneider Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. May 1972 139 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-17; Mitt-82) Avail: NTIS HC $9.00; ZLDI, Munich 28,80 DM

Two-point self-adjoint boundary value problems associated with ordinary differential equations of second order are dealt with. It is assumed that the independent variable is varying in a finite interval; that regular boundary conditions are given; and that systems of differential equations can be fully separated with respect to the differential operator. Some results are illustrated by dealing with the boundary value problem of the first order. Author (ESRO)

N73-31759# Technischen Universitaet, Munich (West Germany). Sonderforschungsbereich 78 Satellitengeodaesie.
SOLVING INITIAL-VALUE PROBLEMS OF ORBITAL MECHANICS BY MEANS OF BOUNDARY-VALUE PROBLEMS [UEBER DIE LOESUNG VON ANFANGSWERTPROBLEMEN DER PUNKTMECHANIK MIT HILFE VON RANDWERTPROBLEMEN]
Manfred Schneider Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Aug. 1972 30 p refs In GERMAN; ENGLISH summary Sponsored in part by Deut. Forschungsgemeinschaft
(Contract WRK-132; WRK-187)
(BMBW-FB-W-72-23) Avail: NTIS HC $3.50; ZLDI, Munich 5,90 DM

To solve initial value problems of orbital mechanics, a method using the Hammerstein's method for solution of boundary value problems is proposed. Possible applications to celestial mechanics and satellite geodesy are outlined. ESRO

N73-31760# Royal Observatory, Edinburgh (Scotland).
REPORT OF THE ASTRONOMER ROYAL FOR SCOTLAND FOR THE YEAR ENDING 31 MARCH 1973
H. A. Brueck Sci. Res. Council 31 Mar. 1973 16 p
Avail: NTIS HC $3.00

The observatory's work in various fields during the year ending 31st March 1973 is presented. Data on the interstellar medium, young star clusters, stellar structures, infrared and ultraviolet spectroscopy and photometry, and site testing are included. ESRO

N73-31868* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH ENERGY AND SOLAR ASTRONOMY, OVERVIEW
Frank B. McDonald *In its* Significant Accomplishments in Sci. 1973 p 7-8 refs (For availability see N73-31867 22-34)
CSCL 03A

N73-31870* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY OBSERVATIONS OF THE SUPERNOVA REMNANTS Cas A AND TYCHO
Axel Brisken *In its* Significant Accomplishments in Sci. 1973 p 12-15 (For availability see N73-31867 22-34)
CSCL 03A

N73-31882* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL AND UV ASTRONOMY, OVERVIEW
Anne B. Underhill *In its* Significant Accomplishments in Sci. 1973 p 71-75 (For availability see N73-31867 22-34)
CSCL 03A

N73-31883* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET OBSERVATIONS OF PECULIAR B AND A STARS FROM OAO-2
David S. Leckrone *In its* Significant Accomplishments in Sci. 1973 p 76-78 (For availability see N73-31867 22-34)
CSCL 03A

N73-31884* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

UV PHOTOMETRY OF ECLIPSING VARIABLES
Stanley Sobieski *In its* Significant Accomplishments in Sci. 1973 p 79-81 (For availability see N73-31867 22-34)
CSCL 03A

N73-31885* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FORMATION OF PLANETARY NEBULAE
Warren M. Sparks *In its* Significant Accomplishments in Sci. 1973 p 82-84 (For availability see N73-31867 22-34)
CSCL 03C

N73-31886* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERSTELLAR MOLECULAR HYDROGEN OBSERVED IN THE ULTRAVIOLET SPECTRUM OF DELTA SCORPII
Andrew M. Smith *In its* Significant Accomplishments in Sci. 1973 p 85-87 refs (For availability see N73-31867 22-34)
CSCL 03A

N73-31888* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SULFUR DOUBLET IN GALACTIC H-II REGIONS
Curtic W. McCracken *In its* Significant Accomplishments in Sci. 1973 p 92-95 (For availability see N73-31867 22-34)
CSCL 03C

N73-31889* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERSTELLAR POLARIZATION IN THE ULTRAVIOLET
Theodore P. Stecher *In its* Significant Accomplishments in Sci. 1973 p 96-99 (For availability see N73-31867 22-34)
CSCL 03B

N73-31890* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 100-MICRON OBSERVATIONS OF GALACTIC AND EXTRAGALACTIC SOUTHERN HEMISPHERE OBJECTS
William F. Hoffmann *In its* Significant Accomplishments in Sci. 1973 p 100-103 (For availability see N73-31867 22-34)
CSCL 03A

N73-31891* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLANETARY, LUNAR, AND COMETARY STUDIES, OVERVIEW
Norman F. Ness *In its* Significant Accomplishments in Sci. 1973 p 107-112 (For availability see N73-31867 22-34)
CSCL 03C

N73-31892* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARS: ITS ATMOSPHERE AND SURFACE
Rudolph A. Hanel *In its* Significant Accomplishments in Sci. 1973 p 113-122 (For availability see N73-31867 22-34)
CSCL 03B

N73-31893* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RETURNED LUNAR SAMPLE ANALYSIS
John A. Philpotts *In its* Significant Accomplishments in Sci. 1973 p 123-126 (For availability see N73-31867 22-34)
CSCL 03B

N73-31896* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHEMICAL EVOLUTION OF COSMIC CLOUDS
Bertram D. Down *In its* Significant Accomplishments in Sci. 1973 p 136-141 (For availability see N73-31867 22-34)
CSCL 03C

N73-31897* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMET ENCKE: METEOR METALLIC ION IDENTIFICATION BY MASS SPECTROMETER
Richard A. Goldberg and Arthur C. Aikin *In its* Significant Accomplishments in Sci. 1973 p 142-147 refs (For availability see N73-31867 22-34)
CSCL 03B

N73-31898* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMETARY SPECTRAL ISOPHOTES
William M. Jackson *In its* Significant Accomplishments in Sci. 1973 p 148-152 (For availability see N73-31867 22-34)
CSCL 03B

N73-31899* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSIONS TO COMETS
Robert W. Farquhar *In its* Significant Accomplishments in Sci. 1973 p 153-157 (For availability see N73-31867 22-34)
CSCL 22A

N73-31907* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLOUD EMISSIVITY
Robert J. Curran *In its* Significant Accomplishments in Sci. 1973 p 201-204 (For availability see N73-31867 22-34)
CSCL 04A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-31761*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: COMMAND AND SERVICE MODULE INSTRUMENTATION SUBSYSTEM
Frank A. Rotramel Washington Aug. 1973 25 p
(NASA-TN-D-7374; JSC-S-351) Avail: NTIS HC $2.75 CSCL 22B

A review of the Apollo command and service module instrumentation subsystem is presented. The measurements provided, design aspects considered, problems encountered, and flight results obtained are discussed. Author

N73-31762*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TEST STAND FOR PRECISE MEASUREMENT OF IMPULSE AND THRUST VECTOR OF SMALL ATTITUDE CONTROL JETS
James R. Woodruff and Dean M. Chisel Washington Aug. 1973 40 p refs
(NASA-TN-D-7402; A-4846) Avail: NTIS HC $3.00 CSCL 14B

A test stand which accurately measures the impulse bit and thrust vector of reaction jet thrusters used in the attitude control system of space vehicles has been developed. It can be used to measure, in a vacuum or ambient environment, both impulse and thrust vector of reaction jet thrusters using hydrazine or inert gas propellants. The ballistic pendulum configuration was selected because of its accuracy, simplicity, and versatility. The pendulum is mounted on flexure pivots rotating about a vertical axis at the center of its mass. The test stand has the following measurement capabilities: impulse of 0.00004 to 4.4 N-sec (0.00001 to 1.0 lb-sec) with a pulse duration of 0.5 msec to 1 sec; static thrust of 0.22 to 22 N (0.05 to 5 lb) with a 5 percent resolution; and thrust angle alinement of 0.22 to 22 N (0.05 to 5 lb) thrusters with 0.01 deg accuracy. Author

N73-31763*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: SERVICE PROPULSION SUBSYSTEM
Cecil R. Gibson and James A. Wood Washington Aug. 1973 25 p
(NASA-TN-D-7375; JSC-S-378) Avail: NTIS HC $2.75 CSCL 22B

The significant service propulsion subsystem development, qualification, and flight experience from the early portion of the Apollo Program through the first lunar-landing mission is presented. Particular emphasis is given to problems encountered and solutions used to eliminate the problems. Author

N73-31764*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUMMARY OF ATTITUDE DYNAMIC ANALYSIS FOR IMP-J WIRE ANTENNA SPACECRAFT
L. W. Bell Sep. 1973 26 p refs
(NASA-TM-X-70465; X-732-73-256) Avail: NTIS HC $3.50 CSCL 22C

The work is reported in the determination of acceptable deployment sequences, simulation of EFM antenna deployment, and contingency analysis for the IMP-J S/C. The spacecraft, mission profile and deployment sequences are described along with the simulation of EFM deployment and deployment failure. F.O.S.

N73-31765*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FIRST EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS-1)
William Nordberg Aug. 1973 19 p refs Presented at 14th Meeting of COSPAR, Konstanz, West Germany, 25 May 1973 Submitted for Publication
(NASA-TM-X-70462; X-650-73-241) Avail: NTIS HC $3.00 CSCL 22C

The first Earth Resources Technology Satellite (ERTS-1) makes images of the earth's surface in four portions of the electromagnetic spectrum with sufficient spatial resolution and with a minimum of geometric distortions, so that these images may be applied experimentally to the study of geophysical processes relating to earth resources, to the exploration and conservation of these resources, and to the assessments of environmental stresses. During the first six months of operation, ERTS-1 has imaged 6.5 million square kilometers of the earth's surface every day, covering most major land masses and coastal zones as well as both polar regions of this planet. These images as well as the results of their analyses are available to all people throughout the world. Scientific investigators of all countries have been invited to participate in the utilization of ERTS-1 observations. Many of them have already demonstrated the great efficiency, economy, and reliability of making earth surveys from space. Author

N73-31766*# Martin Marietta Corp., Denver, Colo.
A FEASIBILITY STUDY OF DEVELOPING TOROIDAL TANKS FOR A SPINNING SPACECRAFT Final Report
John E. Anderson and Dale A. Fester Sep. 1973 78 p refs (Contract NAS2-7489)
(NASA-CR-114666; MCR-73-223) Avail: NTIS HC $6.00 CSCL 22B

A study was made to determine the feasibility of developing toroidal propellant tanks for a bipropellant (N204/MMH) propulsion system to be used in a proposed advanced Pioneer spin-stabilized vehicle intended for a Jupiter-orbiter and possibly a Saturn-orbiter mission. The rationale for considering the use of two toroidal tanks rather than the proposed use of four spherical tanks includes the belief that a more symmetrical distribution of propellant mass and a smaller variation in the position of the vehicle center-of-mass during propellant consumption would result, reducing requirements for attitude-control propellants, for balance weight, and for other weights associated with the dynamics of the spinning spacecraft. Results lead to the conclusion that a toroidal tank containing an effective, passive surface tension propellant acquisition device could be fabricated with available manufacturing methods and could be used interchangeably for either fuel or oxidizer. Author

N73-31767*# Radio Corp. of America, Princeton, N.J.
ENGINEERING DESIGN, STRESS AND THERMAL ANALYSIS, AND DOCUMENTATION FOR SATS PROGRAM
24 Jul. 1973 15 p
(Contract NAS5-21750)
(NASA-CR-132800) Avail: NTIS HC $3.00 CSCL 22B

An in-depth analysis and mechanical design of the solar array stowage and deployment arrangements for use in Small Applications Technology Satellite spacecraft is presented. Alternate approaches for the major elements of work are developed and evaluated. Elements include array stowage and deployment arrangements, the spacecraft and array behavior in the spacecraft despin mode, and the design of the main hinge and segment hinge assemblies. Feasibility calculations are performed and the preferred approach is identified. Author

N73-31768*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: COMMAND MODULE CREW-COUCH/RESTRAINT AND LOAD-ATTENUATION SYSTEMS
Ralph E. Drexel and Howard N. Hunter Washington Sep. 1973 19 p refs
(NASA-TN-D-7440; JSC-S-379) Avail: NTIS HC $2.75 CSCL 06K

The Apollo command module crew-couch/restraint and load-attenuation system was required to support and restrain the crewman during mission phases and to limit the load imposed on the crewman during landing. Component designs evolved when requirements changed and tests were conducted. Advancement in the state of the art for energy-absorbing devices and changes in restraint philosophies for impact protection resulted from the efforts and experiences presented. Author

N73-31769*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: RELIABILITY AND QUALITY ASSURANCE
K. P. Sperber Washington Sep. 1973 38 p refs
(NASA-TN-D-7438; JSC-S-371) Avail: NTIS HC $3.00 CSCL 14D

The reliability of the Apollo spacecraft resulted from the application of proven reliability and quality techniques and from sound management, engineering, and manufacturing practices. Continual assessment of these techniques and practices was made during the program, and, when deficiencies were detected, adjustments were made and the deficiencies were effectively corrected. The most significant practices, deficiencies, adjustments, and experiences during the Apollo Program are described in this report. These experiences can be helpful in establishing an effective base on which to structure an efficient reliability and quality assurance effort for future space-flight programs. Author

N73-31770*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: SPACECRAFT STRUCTURAL WINDOWS
Orvis E. Pigg and Stanley P. Weiss Washington Sep. 1973 25 p refs
(NASA-TN-D-7439; JSC-S-377) Avail: NTIS HC $2.75 CSCL 22B

The window structural design and verification experience is presented for the Apollo command and lunar modules. This report presents window design philosophy, design criteria, hardware description, and qualification and acceptance test programs and discusses the problems encountered and solutions developed in these areas. The structural characteristics of glass are not generally well understood by designers. The optics and instrument glass covers were not considered to be structural components and thus were not normally subjected to the design, qualification, and acceptance standards necessary to preclude failures. These two factors contributed significantly to window problems on both Apollo spacecraft. Author

N73-31771*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: CREW STATION INTEGRATION. VOLUME 4: STOWAGE AND THE SUPPORT TEAM CONCEPT
Marion W. Hix Washington Sep. 1973 30 p
(NASA-TN-D-7434; JSC-S-364-Vol-4) Avail: NTIS HC $3.00 CSCL 22B

Crew equipment stowage and stowage arrangement in spacecraft are discussed. Configuration control in order to maximize crew equipment operational performance, stowage density, and available stowage volume are analyzed. The NASA

crew equipment stowage control process requires a support team concept to coordinate the integration of crew equipment into the spacecraft. Author

N73-31772*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: SYSTEMS AND FLIGHT PROCEDURES DEVELOPMENT
Paul C. Kramer Washington Sep. 1973 55 p
(NASA-TN-D-7436; JSC-S-366) Avail: NTIS HC $3.50 CSCL 22C

This report describes the process of crew procedures development used in the Apollo Program. The two major categories, Systems Procedures and Flight Procedures, are defined, as are the forms of documentation required. A description is provided of the operation of the procedures change control process, which includes the roles of man-in-the-loop simulations and the Crew Procedures Change Board. Brief discussions of significant aspects of the attitude control, computer, electrical power, environmental control, and propulsion subsystems procedures development are presented. Flight procedures are subdivided by mission phase: launch and translunar injection, rendezvous, lunar descent and ascent, and entry. Procedures used for each mission phase are summarized. Author

N73-31773*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: POSTFLIGHT TESTING OF COMMAND MODULES
Donald T. Hamilton Washington Sep. 1973 18 p
(NASA-TN-D-7435; JSC-S-365) Avail: NTIS HC $2.75 CSCL 22B

Various phases of the postflight testing of the command modules used in the Apollo Program are presented. The specific tasks to be accomplished by the task force recovery teams, the National Aeronautics and Space Administration Lyndon B. Johnson Space Center, (formerly the Manned Spacecraft Center) and the cognizant contractors/subcontractors are outlined. The means and methods used in postflight testing and how such activities evolved during the Apollo Program and were tailored to meet specific test requirements are described. Action taken to resolve or minimize problems or anomalies discovered during the flight, the postflight test phase, or mission evaluation is discussed. Author

N73-31774*# Boeing Co., Seattle, Wash. Research and Engineering Div.
EVALUATION OF A METAL SHEAR WEB SELECTIVELY REINFORCED WITH FILAMENTARY COMPOSITES FOR SPACE SHUTTLE APPLICATION. PHASE 1 SUMMARY REPORT: SHEAR WEB DESIGN DEVELOPMENT
J. H. Laakso and D. K. Zimmerman [1972] 213 p refs 3 Vol.
(Contract NAS1-10860)
(NASA-CR-132320; D180-15104) Avail: NTIS HC $12.75 CSCL 22B

An advanced composite shear web design concept was developed for the Space Shuttle orbiter main engine thrust beam structure. Various web concepts were synthesized by a computer-aided adaptive random search procedure. A practical concept is identified having a titanium-clad + or - 45 deg boron/epoxy web plate with vertical boron/epoxy reinforced aluminum stiffeners. The boron-epoxy laminate contributes to the strength and stiffness efficiency of the basic web section. The titanium-cladding functions to protect the polymeric laminate parts from damaging environments and is chem-milled to provide reinforcement in selected areas. Detailed design drawings are presented for both boron/epoxy reinforced and all-metal shear webs. The weight saving offered is 24% relative to all-metal construction at an attractive cost per pound of weight saved, based on the detailed designs. Small scale element tests substantiate the boron/epoxy reinforced design details in critical areas. The results show that the titanium-cladding reliably reinforces the web laminate in critical edge load transfer and stiffener fastener hole areas. Author

N73-31775*# Boeing Co., Seattle, Wash. Research and Engineering Div.
EVALUATION OF A METAL SHEAR WEB SELECTIVELY REINFORCED WITH FILAMENTARY COMPOSITES FOR SPACE SHUTTLE APPLICATION. PHASE 2: SUMMARY REPORT: SHEAR WEB COMPONENT FABRICATION
J. H. Laakso, D. D. Smith, and D. K. Zimmerman Feb. 1973 82 p refs 3 Vol.
(Contract NAS1-10860)
(NASA-CR-132321; D180-15323) Avail: NTIS HC $6.25 CSCL 22B

The fabrication of two shear web test elements and three large scale shear web test components are reported. In addition, the fabrication of test fixtures for the elements and components is described. The center-loaded beam test fixtures were configured to have a test side and a dummy or permanent side. The test fixtures were fabricated from standard extruded aluminum sections and plates and were designed to be reuseable. D.L.G.

N73-31776*# Boeing Co., Seattle, Wash. Research and Engineering Div.
EVALUATION OF A METAL SHEAR WEB SELECTIVELY REINFORCED WITH FILAMENTARY COMPOSITES FOR SPACE SHUTTLE APPLICATION. PHASE 3 SUMMARY REPORT: SHEAR WEB COMPONENT TESTING AND ANALYSIS
J. H. Laakso and J. W. Straayer Aug. 1973 247 p refs 3 Vol.
(Contract NAS1-10860)
(NASA-CR-132322; D180-17566-1) Avail: NTIS HC $14.50 CSCL 22B

Three large scale advanced composite shear web components were tested and analyzed to evaluate application of the design concept to a space shuttle orbiter thrust structure. The shear web design concept consisted of a titanium-clad + or - 45 deg boron/epoxy web laminate stiffened with vertical boron/epoxy reinforced aluminum stiffeners. The design concept was evaluated to be efficient and practical for the application that was studied. Because of the effects of buckling deflections, a requirement is identified for shear buckling resistant design to maximize the efficiency of highly-loaded advanced composite shear webs. An approximate analysis of prebuckling deflections is presented and computer-aided design results, which consider prebuckling deformations, indicate that the design concept offers a theoretical weight saving of 31 percent relative to all metal construction. Recommendations are made for design concept options and analytical methods that are appropriate for production hardware. Author

N73-31777*# Techtran Corp., Silver Spring, Md.
THE BIRTH OF SAFETY
M. Chernyshov Washington NASA Sep. 1973 9 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 7, Jul. 1973 p 36-37
(Contract NASw-2485)
(NASA-TT-F-15077) Avail: NTIS HC $3.00 CSCL 22B

A survey is presented of the engineering safety considerations required for a space program. Author

N73-31778*# North American Rockwell Corp., Downey, Calif. Space Div.
A STUDY OF SPACE SHUTTLE STRUCTURAL INTEGRITY TEST AND ASSESSMENT. PART 1 Final Report
R. E. Anderson and R. G. Poe Jan. 1972 109 p refs
(Contract NAS10-7679)
(NASA-CR-133859; SD-72-SH-0001-Pt-1) Avail: NTIS HC $7.50 CSCL 22B

The ultrasonics technique for assessing the structural integrity of the primary surface of the space shuttle vehicles is discussed and evaluated. Analysis was made of transducers, transducer coupling test structure fabrication, flaws, and ultrasonic testing. Graphs of microphone response curves from the initial noise tests, accelerometer response curves from the final noise tests, and microphone curves from the final noise tests are included along with a glossary, bibliography, and results. K.M.M.

N73-31779*# North American Rockwell Corp., Downey, Calif. Space Div.
A STUDY OF SPACE SHUTTLE STRUCTURAL INTEGRITY TEST AND ASSESSMENT. PART 2: APPENDICES Final

Report
R. E. Anderson and R. G. Poe Jan. 1972 55 p
(Contract NAS10-7679)
(NASA-CR-133815; SD-72-SH-0001-Pt-2-App) Avail: NTIS HC $4.75 CSCL 22B

For abstract, see N73-31778.

N73-31780*# Wilpac Mfg. Co., El Cojon, Calif.
ZERO LEAKAGE SEPARABLE AND SEMIPERMANENT DUCTING JOINTS
H. T. Mischel [1973] 51 p
(Contract NAS8-28159)
(NASA-CR-124386; EDR-20042) Avail: NTIS HC $4.75 CSCL 22B

A study program has been conducted to explore new methods of achieving zero leakage, separable and semipermanent, ducting joints for space flight vehicles. The study consisted of a search of literature of existing zero leakage methods, the generation of concepts of new methods of achieving the desired zero leakage criteria and the development of detailed analysis and design of a selected concept. Other techniques of leak detection were explored with a view toward improving this area. Author

N73-31781*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
AEROELASTIC EFFECTS ON SPACE SHUTTLE DYNAMICS Final Report
29 Jun. 1973 42 p refs
(Contract NAS8-26363)
(NASA-CR-124370; CASD-SST-73-001) Avail: NTIS HC $4.25 CSCL 22B

A simplified analysis procedure for determining static and dynamic aeroelastic loads for the space shuttle and space shuttle configuration is presented. A computer program, originally developed for the Atlas launch vehicle, was modified for simplifying the turbulence response analysis approach. This approach is compared with a more detailed and time consuming approach to space shuttle response to turbulence which was developed earlier. The simplification in going from interference to lumped aerodynamic data was found to give adequate results for preliminary design aeroelastic analysis. Gust loads were found to be approximately 50% of the maximum static aeroelastic loads. The autopilot became unstable when ten elastic modes were included. Elastic effects were found to be less than 3% in the static aeroelastic analysis. K.M.M.

N73-31782*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
DESIGN AND DEVELOPMENT OF PRESSURE AND REPRESSURIZATION PURGE SYSTEM FOR REUSABLE SPACE SHUTTLE MULTILAYER INSULATION SYSTEM Progress Report
19 Jul. 1973 43 p
(Contract NAS8-27419)
(NASA-CR-124380; Rept-632-3-286) Avail: NTIS HC $4.25 CSCL 22B

The manufacturing tasks for the program included the fabrication and assembly of an epoxy fiberglass purge bag to encapsulate an insulated cryogenic propellant tank. Purge, repressurization and venting hardware were procured and installed on the purge bag assembly in preparation for performance testing. The fabrication and installation of the superfloc multilayer insulation (MLI) on the cryogenic tank was accomplished as part of a continuing program. An abstraction of the results of the MLI fabrication task is included to describe the complete fabrication requirements for a reusable cryogenic propellant space storage system. Author

N73-31783*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
OPTIMAL DETUMBLING OF A LARGE MANNED SPACECRAFT USING AN INTERNAL MOVING MASS
Bohdan G. Kunciw Jun. 1973 115 p refs Sponsored in part by NSF
(Grant NGR-39-009-210)
(NASA-CR-135515; PSU-ARR-73-8) Avail: NTIS HC $7.75 CSCL 22B

The use of a movable mass control system to stabilize an arbitrarily tumbling asymmetric vehicle about the maximum inertia axis is considered. A first-order gradient optimization technique is used to minimize angular velocity components along the intermediate and minimum inertia axes. This method permits a wide range of initial guesses for mass position history. Motion of the control mass is along a linear track fixed in the vehicle. The control variable is taken as mass acceleration with respect to body coordinates. Motion is limited to defined quantities and a penalty function is used to insure a given range of positions. Numerical solutions of the optimization equations verify that minimum time detumbling is achieved with the largest permissible movable mass, length of linear track, and positions of the mass on the two coordinates perpendicular to the linear motion. Author

N73-31784*# TRW Systems Group, Redondo Beach, Calif.
THE APPLICATIONS OF SATELLITES TO COMMUNICATIONS, NAVIGATION AND SURVEILLANCE FOR AIRCRAFT OPERATING OVER THE CONTIGUOUS UNITED STATES Executive Summary
J. H. Craigie, D. D. Otten, A. Garabedian, D. D. Morrison, Mallinckrodt, Zipper et al Dec. 1970 49 p refs
(Contract NAS5-21535)
(NASA-CR-132794; TRW-14671-6009-R0-00) Avail: NTIS HC $4.50 CSCL 22B

The objective was to determine on a priority basis the satellite applications to communications, navigation, and surveillance requirements for aircraft operating beyond 1975 over the contiguous United States and adjacent oceanic transition regions, and to determine if and how satellite technology can meet these requirements in a reliable, efficient, and economical manner. Major results and conclusions are as follows: (1) The satellite applications of greatest importance are surveillance and rapid collision warning communications; and (2) The necessary technology is available as demonstrated by an attractive system concept. Author

N73-31785# Sandia Labs., Albuquerque, N.Mex.
FLIGHT TEST EVALUATION OF A FLUIDICALLY ACTUATED MONOPROPELLANT HYDRAZINE ROLL CONTROL SYSTEM
A. E. Hodapp, Jr. and R. C. Beckmann Feb. 1973 23 p refs Sponsored by AEC
(SLA-73-154) Avail: NTIS

The results are presented of flight tests conducted to confirm analytical predictions concerning hydrazine roll control system performance and its effects on the flight dynamic behavior of a reentry vehicle. A roll control system with base plane thrusters and fluidic control logic was flight-tested at supersonic speeds through a simulated low-altitude resonance encounter. Roll torque producing asymmetries were built into the 10-degree conical test vehicle so that, without roll control, persistent resonance (roll-pitch coupling) would occur. Flight test results confirmed analytical predictions; they show that the control system maintained roll control and that system operation remained stable. Flow separation-induced changes in static stability and drag were larger than expected. These undesirable effects, caused by thruster exhaust, can be eliminated with a shroud. Author

N73-31786# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
REPORT ON THE EXTENDED MISSION OF THE INJUN 5 SATELLITE [BERICHT UEBER DIE VERLAENGERTE MISSION DES SATELLITEN INJUN 5]
J. W. Muench, G. R. Pilkington, E. Kirsch, and B. Hente Bad Godeberg, West Ger. Bundesmin. fuer Bildung und Wiss. Aug. 1972 69 p refs In GERMAN; ENGLISH summary Prepared jointly with Tech. Univ., Brunswick
(Contract WRK-225)
(BMBW-FB-W-72-24) Avail: NTIS HC $5.50; ZLDI, Munich 14,10 DM

The scientific aims of the Injun 5 (Explorer 40 satellite) extended mission, a short description of the satellite, and its experiments (LEPEDEA, SSD, and VLF experiments) are presented, as well as the analog and digital data transmission system. Furthermore the behavior of the spacecraft during the extended mission is reported, and examples on data obtained on solar protons, chorus, polar cap absorption, and electron and proton precipitation are given. ESRO

N73-31787# Royal Aircraft Establishment, Farnborough (England).
TABLE OF SPACE VEHICLES LAUNCHED DURING THE YEARS 1958-1972
H. Hiller and J. A. Pilkington (Scarborough Planetarium, Engl.) Feb. 1973 40 p refs
(RAE-TR-73006; BR34098) Avail: NTIS HC $4.00

All known space vehicles launched before 1 January 1973, excluding satellites in geocentric orbits, are tabulated. Details are given of mass, size, shape, orbit, time of launch and other useful information. The table is divided into five sections under the headings: (1) heliocentric orbits, (2) orbits in the earth-moon system, (3) selenocentric orbits - earth launch, (4) selenocentric orbits - moon launch, and (5) areocentric orbits. (Author) ESRO

N73-31788# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
WIND TUNNEL TEST OF RING-WING CANARD CONFIGURATIONS FOR AIR-TO-SURFACE ANTITANK MISSILES
John William Miller Jun. 1973 28 p refs
(DA Proj. 1M3-62303-A-214)
(AD-763899; RD-TR-73-12) Avail: NTIS CSCL 16/4

Two configurations of ring-wing canards were tested for the US Army Missile Command in the Honeywell-Minneapolis subsonic wind tunnel during March 1973. The purpose of that test was to determine center of pressure movement on the ring-wing with changes in angle of attack at increments of 0, plus or minus 1, plus or minus 3, plus or minus 5, plus or minus 7, and plus or minus 10 degrees. Mach numbers were approximately 0.3 and 0.45. Results indicated that center of pressure movement was too great. The desired variation was 1 percent of the wing chord length. Details of the test program and an analysis of the results are presented in the report.
Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-31789 Lehigh Univ., Bethlehem, Pa.
APPLICATIONS OF FINITE ELEMENT ANALYSIS TO NONLINEAR PLANE STRESS PROBLEMS Ph.D. Thesis
John H. A. Struik 1972 158 p
Avail: Univ. Microfilms Order No. 73-10945

The finite element method was applied to nonlinear plane stress problems. Emphasis is placed on material nonlinearities. Several procedures that can be used to perform such an analysis are discussed. A procedure was developed which permits the elements in the transition region to be dealt with. It is further shown that nonplanar plane stress problems can be analyzed using plane stress elements if three degrees of freedom are assigned to nodal points on intersecting planes. It was concluded that the modified stiffness method is the most versatile to use for an elastic-plastic finite element analysis. This method permits an iterative or a scaling approach to be used. A modified scaling procedure was developed to increase the efficiency of the method. The accuracy, efficiency, and stability of the iterative and the scaling methods were examined with various examples.
Dissert. Abstr.

N73-31790 Connecticut Univ., Storrs.
THERMAL STRESS RATCHETING OF STRUCTURES SUBJECTED TO MECHANICAL AND CYCLIC THERMAL STRESSES Ph.D. Thesis
Amaravadi Venkata Swaroop 1972 159 p
Avail: Univ. Microfilms Order No. 73-12035

A mechanical testing technique was developed to study thermal ratcheting in a three bar assembly subjected to an external load and thermal cycling. This simulates the conditions for ratcheting in pressure vessels, aircraft wings and nuclear fuel cladding. The experimental measurements of ratcheting strains showed a remarkable agreement with the theoretical computations that were made considering work hardening and changes in yield strength due to thermal cycling. An improved analytical approach to predict ratcheting behavior has been developed considering different strain hardening rates of the inner and outer bars of three bar assembly. Ratcheting may lead to either ductile fracture or shakedown to thermal fatigue. Stress raisers appreciably reduce the number of cycles required for fracture. The significance of creep in ratcheting is studied in experiments with hold time at the high temperatures. Dissert. Abstr.

N73-31791 Michigan State Univ., East Lansing.
STRESS AND TIME EFFECT ON THE CREEP RATE OF POLYCRYSTALLINE ICE Ph.D. Thesis
Shiou-San Kuo 1972 190 p
Avail: Univ. Microfilms Order No. 73-12756

Information useful in predicting the time-dependent deformational behavior of polycrystalline ice is provided. Creep tests were performed on fine-grained polycrystalline ice under uniaxial and multiaxial stress conditions. Stresses ranged between 23 psi. and 400 psi. All tests were performed at a temperature of -4.45 C. Two forms of ice specimens were used; solid, cylindrical samples, and thin-walled, hollow, cylindrical samples. All samples were formed by pouring cold, high purity water into clean natural snow contained in a pre-cooled aluminum mold. Ice grain sizes ranged between 1 and 2 millimeters in diameter. Results from tests on thin-walled, hollow, cylindrical ice samples confirm the applicability of the creep equation to multiaxial stress states when stress and strain are considered in the octahedral sense. It appears that the resulting principal strain-rates are parallel and proportional to the corresponding stress deviators within acceptable experimental limits. Dissert. Abstr.

N73-31792 Ohio State Univ., Columbus.
DYNAMIC STABILITY OF A SPHERICAL SHELL SUBMERGED IN AN ACOUSTIC MEDIUM Ph.D. Thesis
Juinn-fu Lu 1972 97 p
Avail: Univ. Microfilms Order No. 73-11530

The dynamic stability of the harmonically varying forced vibrations of a thin spherical shell submerged in an acoustic medium is investigated. Both the ordinary parametric excitation and the combination resonance of the shell are discussed. The nonlinear vibrations of the parametrically excited modes are studied numerically. Numerical examples for the ordinary parametric resonance show that the surrounding fluid medium has a great effect on the change of the boundary of the instability regions. The results are compared to the case in vacuo. Only the parameters excitations of the higher composite modes are possible. The instability regions for the second composite mode and all the membrane modes are so high and narrow that the parameters resonances do not occur practically. Dissert. Abstr.

N73-31793 Wayne State Univ., Detroit, Mich.
WAVE PROPAGATION IN THIN ELASTIC SHELLS Ph.D. Thesis
Hossein Ayati 1972 129 p
Avail: Univ. Microfilms Order No. 73-12474

The problem of wave propagation is briefly discussed, and the geometrical and kinematical aspects of a moving surface, and the kinematics of a singular curve are considered. By using Hadamard's Lemma and the definition of the derivative of a scalar and double tensor, the geometrical and kinematical compatibility relations for a scalar and tensor are derived. The governing equations for the decay of the wave on a membrane shell are established. Bending effects are considered using the dynamical Kirchoff-Love theory. Using the constitutive relation of this theory the propagation condition is obtained. Shock and acceleration waves are discussed, and the speed of propagation for each of these waves are obtained. Dissert. Abstr.

N73-31794 Virginia Polytechnic Inst. and State Univ., Blacksburg.
NONLINEAR DEFLECTIONS OF A CIRCULAR PLATE WITH VARYING THICKNESS Ph.D. Thesis
Leighton Akers Caldwell 1972 117 p
Avail: Univ. Microfilms Order No. 73-11614

A theoretical analysis of large deflections and large strains in a circular plate with varying thickness and a circular membrane is considered. The exact tensor first approximation equilibrium

equations, converted into physical equations for a rotationally symmetric thin plate are used with the Alexander constitutive relations for a rubber-like material to analyze the deflections, stress resultants and change in the thickness for a plate clamped along the outer edge and deflected by a uniform pressure applied normal to the deformed surface. The thickness is allowed to vary in the radial direction but is held constant in the circumferential direction. Several variations in thickness were considered. The solutions found by using the Alexander constitutive relations were compared with the solutions using the Rivlin and Saunders constitutive relations and the Hart-Smith constitutive relations. Dissert. Abstr.

N73-31795 Tennessee Univ., Knoxville.
STEADY STATE CREEP IN ORTHOTROPIC MATERIALS Ph.D. Thesis
Shafik Kamel Iskander 1972 109 p
Avail: Univ. Microfilms Order No. 73-12413

With the assumption of material incompressibility and the existence of a creep potential, it was possible to derive simple expressions for the creep rate tensor for the practical case of steady state creep. The creep potential was assumed to be a function of a quadratic invariant formed from the stresses. This quadratic invariant was formed using the theory of classical groups. The resulting expression of the quadratic invariant bears resemblance to the strain energy potential for elastic anisotropic materials, partially verifying the scalar invariant nature of the creep potential. The practically useful cases of orthotropy and plane isotropy were considered. Among the advantages of the type of approach used here is that the material parameters are assumed to be a fourth order tensor. The transformation properties of this tensor can be utilized. Dissert. Abstr.

N73-31796 Michigan Univ., Ann Arbor.
STUDIES ON THE NONLINEAR VIBRATIONS OF SYSTEMS WITH ONE AND TWO DEGREE-OF-FREEDOM Ph.D. Thesis
David Owen Swint 1972 163 p
Avail: Univ. Microfilms Order No. 73-12832

An ultraspherical polynomial (U.P.) approximate method for representing natural vibrations for one and two degree-of-freedom spring-mass systems possessing nonlinear restoring forces is presented. The nonlinear equations of motion are approximated by a set of linear equations over appropriate intervals of an amplitude. General multilinear U.P. relations are developed for approximating nonlinear restoring forces. The special cases of odd restoring forces, $f(x) = \text{alpha } x + \text{beta } x$ to the 3rd power, sin x, and sinh x, are examined in detail, and used in the one degree-of-freedom system to obtain approximate expressions for period-amplitude relations. In general, for these odd functions considered, the bilinear U.P. approximate method gave improved period-amplitude relations as compared to previously published approximate period-amplitude relations obtained from linear U.P. approximations. Dissert. Abstr.

N73-31797 Catholic Univ. of America, Washington, D.C.
EXPERIMENTAL AND THEORETICAL METHODS FOR DETERMINING THE RESPONSE OF RATE-SENSITIVE MATERIALS AND COMPLEX STRUCTURES UNDERGOING LARGE DEFORMATIONS BECAUSE OF DYNAMIC LOADING Ph.D. Thesis
Partha Bhadra 1973 145 p
Avail: Univ. Microfilms Order No. 73-12880

The effect of material rate-sensitivity on dynamically loaded complex structures subjected to large plastic deformations was studied. The study consists of two parts: in the first part, the effect of material rate-sensitivity and strain hardening on the response of dynamically loaded structures subjected to gross deformations was studied theoretically; in the second part, an experimental procedure to study the effect of rate-sensitivity on material behavior was described. Dissert. Abstr.

N73-31798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXTENDED TORSIONAL TESTS OF AN INTERLOCKED BI-STEM SATELLITE BOOM
Richard A. Abercrombie Washington Aug. 1973 26 p refs
(NASA-TN-D-7365; G-7319) Avail: NTIS HC $3.00 CSCL 20K

The effect is reported of continued oscillations of a 1.27-cm interlocked bi-stem satellite boom. The test setup oscillated a boom continuously between set torque limits and periodically recorded its hysteresis characteristics. Results showed that repeated oscillations affected torsional characteristics and that torsional rigidity changed as a function of the number of cycles oscillated within certain torque limits. Torsional characteristics changes caused by repeated oscillations were retained. Author

N73-31799*# Naval Ordnance Lab., White Oak, Md.
CARBON FIBER INTERNAL PRESSURE VESSELS Technical Report, Jan. - Dec. 1972
Robert A. Simon 17 Jul. 1973 32 p refs
(NASA Order C-10360-B)
(NASA-CR-121138; NOLTR-73-60) Avail: NTIS HC $3.75 CSCL 11D

Internal pressure vessels were designed; the filament was wound of carbon fibers and epoxy resin and tested to burst. The fibers used were Thornel 400, Thornel 75, and Hercules HTS. Additional vessels with type A fiber were made. Polymeric linears were used, and all burst testing was done at room temperature. The objective was to produce vessels with the highest attainable PbV/W efficiencies. The type A vessels showed the highest average efficiency: 2.56 x 10 to the 6th power cm. Next highest efficiency was with Thornel 400 vessels: 2.21 x 10 to the 6th power cm. These values compare favorably with efficiency values from good quality S-glass vessels, but strains averaged 0.97% or less, which is less than 1/3 the strain of S-glass vessels. Author

N73-31800# Federal Aviation Administration, Washington, D.C.
A POTENTIAL DESIGN WINDOW FOR SUPERSONIC OVERFLIGHT BASED ON THE PERCEIVED LEVEL (PLdB) AND GLASS DAMAGE PROBABILITY OF SONIC BOOMS Final Report
Thomas H. Higgins and Larry K. Carpenter Aug. 1973 27 p refs
(FAA-RD-73-116) Avail: NTIS HC $3.50

A potential design window for supersonic overflight based on the perceived level (PLdB) and glass damage probability of sonic booms is outlined. The evaluation of a simple operational method of estimating the perceived level (PLdB) of sonic booms is discussed and compared with the Fourier transform computer program calculations of Pease based on the theory of Zepler and Harel. The resulting estimated perceived levels are in good agreement i.e., within 1 to 2 PLdB of each other in the important potential certification or design window that is in the 90 to 100 PLdB range. These perceived levels are shown to be acceptable to 95 to 100 percent of the people exposed to them. Author

N73-31801# Technische Hogeschool, Delft (Netherlands).
FATIGUE AND STOCHASTIC LOADINGS
J. Strating [1973] 265 p refs
(ICAF-Doc-683) Avail: NTIS HC $15.25

An alternate approach to the Wohler fatigue test is presented. The influence of the probability density function and the power spectral density function on the fatigue life of an electrosteel test specimen is examined. Three types of probability density functions were used: Gaussian, triangular, and rectangular. These functions were used in combinations with four types of power spectra: constant, linear decreasing, single-peak, and double-peak. Test showed that the influence of the shape of the power spectrum on the fatigue life is small. The random load tests are described, and results are presented along with a review of literature in the field. A discussion of the test results and conclusions are included. K.M.M.

N73-31802*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SINUSOIDAL-VIBRATION ANALYSIS PROGRAM FOR EXPERIMENTAL DATA
James A. Schoenster and Nancy L. Taylor Washington Oct. 1973 76 p refs
(NASA-TM-X-2789; L-8729) Avail: NTIS HC $3.75 CSCL 20K

A program is described for obtaining resonant frequencies, modal amplitudes, and damping of a structure from a sinusoidal force-controlled vibration test. Presented are the theoretical basis for the analysis (the Kennedy-Pancu method), recommendations for a test procedure based on experience with several earlier test programs, and an outline of the data analysis technique. Although the program was developed for structural vibration problems, variations for processing any sinusoidal data are available. Author

N73-31803*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF BOUNDARY INTEGRAL METHOD TO ELASTIC ANALYSIS OF V-NOTCHED BEAMS
Walter Rzaswicki, Alexander Mendelson, and Lynn U. Albers Washington Oct. 1973 29 p refs
(NASA-TN-D-7424; E-7156) Avail: NTIS HC $3.00 CSCL 20K

A semidirect boundary integral method, using Airy's stress function and its derivatives in Green's boundary integral formula, is used to obtain an accurate numerical solution for elastic stress and strain fields in V-notched beams in pure bending. The proper choice of nodal spacing on the boundary is shown to be necessary to achieve an accurate stress field in the vicinity of the tip of the notch. Excellent agreement is obtained with the results of the collocation method of solution. Author

N73-31804*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
PROPERTIES OF MATERIALS IN HIGH PRESSURE HYDROGEN AT CRYOGENIC, ROOM, AND ELEVATED TEMPERATURES Final Report, 29 Jun. 1970 - 31 Jul. 1973
J. A. Harris, Jr. and M. C. VanWanderham 31 Jul. 1973 129 p refs
(Contract NAS8-26191)
(NASA-CR-124394; FR-5768) Avail: NTIS HC $8.50 CSCL 20K

Various tests were conducted to determine the mechanical properties of 12 alloys that are commonly used or proposed for use in pressurized gaseous hydrogen or hydrogen containing environments. Properties determined in the hydrogen environments were compared to properties determined in a pure helium environment at the same conditions to establish environmental degradation. The specific mechanical properties tested include: high-cycle fatigue, low-cycle fatigue, fracture mechanics, creep-rupture, and tensile. D.L.G.

N73-31805*# Boeing Aerospace Co., Huntsville, Ala.
SSME STRUCTURAL COMPUTER PROGRAM DEVELOPMENT. VOLUME 1: BOPACE THEORETICAL MANUAL
R. G. Vos 31 Jul. 1973 83 p refs
(Contract NAS8-29821)
(NASA-CR-124390; D5-17266-1-Vol-1) Avail: NTIS HC $6.25 CSCL 20K

The BOPACE program (Boeing plastic analysis capability for engines) was developed to meet the need for an advanced thermal-elastic-plastic-creep structural analyzer by providing incremental relation between stresses and strains. The cumulative stress-strain relation, for temperature-dependent, or temperature independent elasticity is discussed along with the option for plane-stress analysis or plane-strain analysis. The BOPACE solution approach is summarized. F.O.S.

N73-31806*# Boeing Aerospace Co., Huntsville, Ala.
SSME STRUCTURAL COMPUTER PROGRAM DEVELOPMENT. VOLUME 2: BOPACE USERS MANUAL
R. G. Vos 31 Jul. 1973 160 p refs
(Contract NAS8-29821)
(NASA-CR-124391; D5-17266-2-Vol-2) Avail: NTIS HC $10.00 CSCL 20K

A computer program for use with a thermal-elastic-plastic-creep structural analyzer is presented. The following functions of the computer program are discussed: (1) analysis of very high temperature and large plastic-creep effects, (2) treatment of cyclic thermal and mechanical loads, (3) development of constitutive theory which closely follows actual behavior under variable temperature conditions, (4) stable numerical solution approach which avoids cumulative errors, and (5) capability of handling up to 1000 degrees of freedom. The computer program is written in FORTRAN IV and has been run on the IBM 360 and UNIVAC 1108 computer systems. Author

N73-31807*# Boeing Aerospace Co., Huntsville, Ala.
SSME STRUCTURAL COMPUTER PROGRAM DEVELOPMENT. VOLUME 3: BOPACE DEMONSTRATION ANALYSIS OF THE SSME THRUST CHAMBER LINER
A. H. Spring 31 Jul. 1973 74 p refs
(Contract NAS8-29821)
(D5-17266-3-Vol-3) Avail: NTIS HC $5.75 CSCL 20K

The application of a structural computer program for analysis of a thrust chamber liner is discussed. Two objectives were accomplished as follows: (1) exercise of the full capabilities of the computer program and (2) definition of thermal and mechanical boundary conditions to reflect the emergency power level operating conditions for the SSME 470K engine at a station just upstream of the thrust chamber throat. Creep information on the thrust chamber is presented as a reference curve of creep strain versus time for various temperatures. Contour plots of the effective plastic strain, effective stress, and effective creep strain are developed. Author

N73-31808# Technische Univ., Berlin (West Germany). Inst. fuer Raumfahrttechnik.
VIBRATIONS OF CYLINDRICALLY CURVED SANDWICH SHELLS, WITH FLEXIBLE SUPPORTS AND RIGID CLAMPING, AT RESONANCE AND UNDER ACOUSTIC LOADS [SCHWINGUNGEN ZYLINDRISCH GEKRUEMMTER GELENKIG GELAGERTER UND FEST EINGESPANNTER SANDWICHSCHALEN BEI RESONANZ UND UNTER SCHALLBELASTUNG]
H. K. Petrick Dec. 1972 70 p refs In GERMAN; ENGLISH summary
(TUB-IR-1972/2) Avail: NTIS HC $5.50

The vibration of a cylindrically curved sandwich shell was analyzed by two methods: the approximate solution of the differential equations and the energy method. Beam functions for the mode shapes were applied not only to the flexibly supported but also to the fixed edges of the shell. By solving the set of linear equations, the frequencies of vibration and the ratios of the deflection and stress amplitudes were computed for the sandwich shell, strip, and cylinder. The analysis of the shell's response to random pressure fields is demonstrated. From this, it is then possible to calculate the spectral expressions of deflection, acceleration, and stress at arbitrary shell coordinates. ESRO

N73-31809# Naval Ship Research and Development Center, Bethesda, Md.
A GENERAL PURPOSE OVERLAY LOADER FOR CDC-6000 SERIES COMPUTERS; MODIFICATION OF THE NASTRAN LINKAGE EDITOR
Roger J. Martin Apr. 1973 89 p refs
(ZR0990101)
(AD-764044; NSRDC-4062) Avail: NTIS CSCL 13/13

The NASTRAN Linkage Editor is a general purpose linkage editor which provides a means of using available main memory to accommodate large programs which will not fit into the available main memory. As originally designed the NASTRAN Linkage Editor required run FORTRAN compiled input. This report describes a modified and improved version of the Linkage Editor which has been extended to accept either run FORTRAN compiled or FORTRAN compiled or FORTRAN EXTENDED compiled input. The NASA Structural Analysis (NASTRAN) computer program has been implemented on a variety of large IBM, UNIVAC and CDC computers. Author (GRA)

N73-31810# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SNAPPING OF A LONG CURVED PANEL INDUCED BY CREEP
Shyh-Ning Liu 2 Jul. 1973 20 p refs Transl. into ENGLISH from Li Hsueh Hseuth Pao (Mainland China), v. 5, no. 4, 1962 p 217-226
(AF Proj. 7351)
(AD-764311; FTD-HC-23-535-73) Avail: NTIS CSCL 20/11

In the report, the problem of creep-induced buckling of an infinitely long curved sandwich panel under uniform pressure is discussed. It is assumed that the prebuckling deformation of the perfect panel is symmetric and that the temperature field is uniform. In the analysis, the determination of the critical snapping conditions and the determination of the critical time are discussed separately. The former reduces to an eigenvalue problem. The formulation of the matter is based upon the flow theory of creep while neglecting the elastic deformation and the higher order terms in bending moment. Author (GRA)

N73-31811# Del Research Corp., Bethlehem, Pa.
STRESS ANALYSIS OF THICK WALL CYLINDRICAL VESSELS WEAKENED BY FLAWS Final Report, 30 Jun. 1970 - 1 Apr. 1971
George C-M Sih 1973 9 p
(Contract DAHC04-70-C-0053; DA Proj. 200-61102-B-33G)
(AD-764279; AROD-8137-1-E) Avail: NTIS CSCL 20/11

The stress analysis is considered of a surface flaw embedded in the thickness direction of a plate or the wall of a pressure vessel. An approximate means of evaluating the stress-intensity factor for a semi-elliptical surface flaw was considered. The aim of these calculations is to assist laboratory measurements on the propagation of surface cracks under static and cyclic loadings. Author (GRA)

N73-31812# California Univ., Berkeley. Structural Engineering Lab.
ELASTIC-PLASTIC DYNAMIC ANALYSIS OF AXI-SYMMETRIC SOLIDS Report for June 1972 - 1973
S. Nagarajan and E. P. Popov Jul. 1973 87 p refs
(Contract DAAA21-72-C-0727)
(AD-764244; UCSESM-73-9) Avail: NTIS CSCL 20/11

The report presents a computer program for the elastic-plastic dynamic analysis of shells of revolution. General isoparametric elements with curved sides are used in the finite element discretization. These are capable of representing solids of revolution in the form of a layered system. Structures with complex geometries and sharp discontinuities may be studied. Solutions can be obtained for both thin and thick shells because the customary Kirchhoff-Love hypothesis is not invoked. Dynamic analysis is carried out by means of step-by-step intergration, the program allowing for the use of any of the schemes belonging to the Newmark family of methods (with free parameters gamma and beta) and the Wilson and Farhoomand theta method. Flow theory of plasticity is used in the inelastic range, and either isotropic hardening or kinematic linear hardening may be adopted. The program can analyze axisymmetric structures subjected to axially symmetric loading as well as plane stress problems. Numerical examples presented include the static analysis of a fixed end beam and the dynamic analyses of a cantilever, a simply supported beam, and two spherical caps. Author (GRA)

N73-31813# Army Foreign Science and Technology Center, Charlottesville, Va.
STRESS CONCENTRATION AT HOLES
A. N. Guz 9 Mar. 1973 12 p refs Transl. into ENGLISH from unidentified Russian article
(AD-764169; FSTC-HT-23-1742-72) Avail: NTIS CSCL 20/11

The report consists of two parts. The first part surveys the research on this problem for thin-walled structures. The second part surveys reports on the concentration of stresses. GRA

N73-31814# Naval Weapons Center, China Lake, Calif.
THE APPROACH OF TWO BODIES SEPARATED BY A PERFECTLY ELASTIC PARTICLE
Daniel T. Gillespie Jul. 1973 18 p
(AD-764514; NWC-TP-5474) Avail: NTIS CSCL 20/11

A variation on the familiar one-dimensional elastic collision problem is considered, in which the two approaching masses are separated by a small, perfectly elastic particle. The back-and-forth motion of the trapped particle mediates the collision of the two masses, and reverses their relative motion short of actual contact. The calculation of the distance of closest approach, and of the total number of particle encounters required to turn the masses around, can be used to illustrate several basic mathematical techniques. Author (GRA)

N73-31815# Notre Dame Univ., Ind. Coll. of Engineering.
INELASTIC BUCKLING OF A DEEP SPHERICAL SHELL SUBJECT TO EXTERNAL PRESSURE
N. C. Huang and G. Funk Jul. 1973 70 p refs
(Contract N00014-68-A-0152; NR Proj. 260-112)
(AD-764085; UND-73-7) Avail: NTIS CSCL 13/10

The report is concerned with the investigation of the inelastic buckling of a deep spherical shell subject to a uniformly distributed external pressure. The geometry of the shell is considered to be axisymmetrical while the shell thickness may vary as a function of the polar angle. The edge of the shell is supported elastically. The material of the shell is assumed to satisfy the generalized Ramberg-Osgood stress-strain relations and a power law of steady creep. The analysis is based on Sander's nonlinear theory of thin shells expressed in an incremental form and Hill's theory of inelastic bifurcation. Computations are carried out by a numerical iterative procedure associated with a finite difference method. Solutions are sought for both the axisymmetrical inelastic buckling and the asymmetrical bifurcation. Author (GRA)

N73-31816# Army Foreign Science and Technology Center, Charlottesville, Va.
SOME FUNDAMENTAL PROBLEMS OF THE THEORY OF THERMOVISCOELASTICITY
D. L. Bykov, A. A. Ilyushin, P. M. Ogivalov, and B. E. Pobedrya 13 Mar. 1973 28 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), v. M1, 1971 p 41-58
(AD-763937; FSTC-HT-23-2418-72) Avail: NTIS CSCL 20/11

Methods of solving quasistatic problems in the linear theory of thermoviscoelasticity are discussed. The principal relationships of the nonlinear theory of thermoviscoelasticity are set forth. Techniques for solving problems of several nonlinear theories are outlined. Author (GRA)

N73-31817# Sydney Univ. (Australia). Civil Engineering Labs.
STABILITY OF VISCO-ELASTIC STRUCTURAL MEMBERS
J. R. Booker, B. S. Frankham, and N. S. Trahair Dec. 1972 33 p refs
(PB-221835/2; R-201) Avail: NTIS HC $3.75 CSCL 20K

A method of analysing the buckling behavior of a visco-elastic structural member is presented. The method uses the visco-elastic correspondence principle to convert the visco-elastic buckling problem to an equivalent elastic problem, the solution of which may be well known or may be readily obtained by standard techniques. A number of specific problems are solved for the particular case of a material whose visco-elastic behavior may be represented by a three parameter model which has both an initial and a final elastic response. GRA

N73-31818# Naval Ship Research and Development Center, Bethesda, Md.
PROCEEDINGS OF THE FOURTH NAVY-NASTRAN COLLOQUIM
27 Mar. 1973 182 p Colloquim held at Washington, D.C., 27 Mar. 1973
(AD-764508) Avail: NTIS CSCL 09/2

Contents: Finite element analysis of SWATH ship; SWATH ship pre- and post-processors for NASTRAN; CONN4: A NASTRAN threaded connection aid; Finite element analysis of a multiconductor armored cable; Bearing surfaces in static two-body problems; NASTRAN status and plans; CAPTOR propeller housing - Design improvement and weight reduction using NASTRAN; NASTRAN applications to army gun components; Fluid finite elements; A transient response structural analysis of a restricted breech plenum chamber; A finite element approach to acoustic radiation from elastic structures; Analysis of ring-stiffened cylinder using conical shell elements; NASTRAN analysis of vibration damping effects of rubber pellets on circuit boards; Normal modes analysis with differential stiffness; NASTRAN mesh generation; Comparison of test and NASTRAN results for a radar unit; Use of NASTRAN for the calculation of hydrofoil flutter speeds; Applications of the finite element method and computer graphics; Navy NASTRAN development: Past and future. GRA

N73-31819# Army Foreign Science and Technology Center, Charlottesville, Va.
INFLUENCE OF PHYSICAL AND GEOMETRICAL NON-

LINEARITIES ON STRESS AND STRAIN DISTRIBUTION ALONG A CIRCULAR HOLE IN AN INFINITE REGION
V. G. Savchenko 8 Jan. 1973 9 p refs Transl. into ENGLISH from Tepl. Napryazh. v Elementakh Konstrukt. (Kiev), no. 10, 1970 p 67-79
(AD-764104; FSTC-HT-23-2319-72) Avail: NTIS CSCL 20/11

Consideration is given to two-dimensional physically and geometrically nonlinear problems of thermal elasticity for an infinite space with a round, cylindrical cavity (two dimensional strain) as well as for an infinite plate with a circular hole (two-dimensional stressed state). GRA

N73-31820# Army Foreign Science and Technology Center, Charlottesville, Va.
MECHANICS OF A CONTINUOUS MEDIUM
A. A. Ilyushin 15 May 1973 314 p refs Transl. into ENGLISH of the publ. "Mekhanika Sploshnoy Sredy" Moscow, Moscow Univ., 1971
(AD-764370; FSTC-HT-23-2385-72) Avail: NTIS CSCL 20/11

The book discusses the foundations of the mechanics of a continuous medium (MCM), the physical treatment of the fundamental concepts and the statistical foundation of MCM laws, MCM axioms, the kinematics and theory of internal stresses in media, physical laws for the conservation of mass, pulse, energy and entropy balance, methods for deriving closed systems of equations, basic typical boundary conditions, and the formulation of MCM boundary value problems. Closed system of equations are given for classical media (gases, liquids, elastic, nonlinearly viscose, elasto-and visco-plastic media, plasma, etc.) under the action of the electromagnetic field. Dimensionality and similarity theory are presented with a revised analysis of MCM equations similarity and modeling criteria, with examples of solutions.
Author (GRA)

N73-31821# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
RESPONSE OF RECTANGULAR PLATES TO STATIONARY RANDOM EXCITATION BY THE EQUIVALENT LINEARIZATION TECHNIQUE Interim Report
Hidekichi Kanematsu and William A. Nash Dec. 1972 56 p refs
(Grant AF-AFOSR-1527-68; AF Proj. 9782)
(AD-763782; AFOSR-73-1153TR) Avail: NTIS CSCL 20/11

In the present study, the procedure for obtaining an approximate solution for the mean-square response of geometrically nonlinear plates to random excitation with arbitrary power spectral density by taking into account the influence of the various modes represented in the response is presented. The equivalent linearization technique has been used for this purpose. As an illustration of this procedure, the mean-square response of a simply supported rectangular plate to both white and non-white random excitation is determined. It has been shown that the response corresponding to the fundamental mode is predominant if the damping of the system is small and if the power spectral density of the excitation does not have any very sharp peaks around the frequencies corresponding to higher modes. It is expected that the mean-square response of lightly damped nonlinear plates with arbitrary boundary conditions and subject to random excitation with a given power spectral density can be obtained by the equivalent linearization technique with reasonably good accuracy. Author (GRA)

N73-31822# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF STRAIN WAVE PROPAGATION IN METALLIC CONICAL RODS Final Report, Jan. 1968 - Jul. 1972
J. P. Billingsley, P. A. Evans, and R. L. Nenninger AEDC Jun. 1973 71 p refs
(AD-762504; ARO-VKF-TR-73-41; AEDC-TR-73-94) Avail: NTIS CSCL 19/1

Strain wave propagation in metal cones with a compressive pulse applied at the base has been investigated experimentally and theoretically. This study was motivated by the need for design information for gun-launched models used in aerophysics research. The results are also directly applicable to the design of ordinary gun-launched munitions or to any other cases of impulsive loading on conical bars. The effect of the following parameters was considered: cone angle, cone tip joint (threaded connection), and cone tip material variation (7075-T6 base with 7075-T6, beryllium-copper, and Fansteel 60 tips). Transient strains were measured with strain gages mounted at critical locations on the specimen. (Modified author abstract) GRA

N73-31823# California Univ., Berkeley. Earthquake Engineering Research Center.
GENERAL PURPOSE COMPUTER PROGRAM FOR INELASTIC DYNAMICS RESPONSE OF PLANE STRUCTURES
Amin E. Kanaan and Graham H. Powell Apr. 1973 166 p refs
(Grant NSF GI-36387)
(PB-221260/3; EERC-73-6) Avail: NTIS HC $6.00 CSCL 20K

A computer program for the dynamic response anslysis of inelastic plane structures of arbitrary configuration is described. The program consists of a series of base subroutines which carry out a step-by-step dynamic analysis. Subroutines for structural elements of a variety of types may be developed independently and added to the base program. Subroutines for arbitrarily oriented truss elements; arbitrarily oriented beam column elements, infill shear panel elements and semi-rigid connection elements have been developed and are described. The direct stiffness method is reviewed, with particular emphasis on the selection of displacement and deformation degrees of freedom. The step-by-step dynamic analysis procedure for inelastic structures is considered in detail. Instructions to be followed when adding new elements to the program are presented.
(Modified author abstract) GRA

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-31824 Michigan Univ., Ann Arbor.
MODELS FOR THERMAL EXHAUST REACTORS: LIMITS ON PERFORMANCE POSED BY MIXING AND THERMAL QUENCHING Ph.D. Thesis
Everett Anthony Sondreal 1972 276 p
Avail: Univ. Microfilms Order No. 73-11263

A theoretical framework for the design of noncatalytic thermal exhaust reactors has been synthesized taking into account both the full extent of chemical reactor design theory and the high frequency cyclic operating characteristics of internal combustion engines. An array of analytical design tools in the form of highly adaptive computer simulation programs has been developed to aid in continued design efforts on exhaust reactors and in other areas of combustion technology where turbulent mixing and thermal quenching are determining factors. Dissert. Abstr.

N73-31825 Wisconsin Univ., Madison.
THE FORMATION OF NITRIC OXIDE IN DIFFUSION FLAMES Ph.D. Thesis
Arjun Dev Tuteja 1972 244 p
Avail: Univ. Microfilms Order No. 73-7222

The oxides of nitrogen are among the major pollutants associated with combustion processes. The principal oxide of nitrogen formed in such processes is nitric oxide, and as a consequence its formation in combustion processes is of interest. An experimental ahp theoretical investigation of the formation of nitric oxide in a steady laminar diffusion flame is reported. The experimental work has involved determination of nitric oxide concentration profiles within the flame. In addition, concomitant temperature profiles and concentration profiles for CO, CO2, O2, N2 and methane, the fuel used in the study, were determined. Dissert. Abstr.

N73-31826*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

REMOTE FIRE STACK IGNITER Patent Application
William L. Ray, inventor (to NASA) Filed 29 Aug. 1973 16 p (NASA-Case-MFS-21675-1; US-Patent-Appl-SN-392823) Avail: NTIS HC $3.00 CSCL 20M

An igniter mounted on a vent stack is described with an upper, flame case near the top of the stack to ignite emissions from the stack. The igniter is a tube with a lower, open, flared end having a spark plug near the lower end and a solenoid-controlled valve which supplies propane fuel from a supply tanks. Propane from the tank is supplied at the top under control of a second, solenoid-controlled valve. The valve controlling the lower supply is closed after ignition at the flame cage. NASA

N73-31827*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAT PIPE INVESTIGATIONS
James P. Marshburn Washington Aug. 1973 49 p refs (NASA-TN-D-7219; G-7311) Avail: NTIS HC $3.00 CSCL 20M

Techniques associated with thermal-vacuum and bench testing, along with flight testing of the OAO-C spacecraft heat pipes are outlined, to show that the processes used in heat transfer design and testing are adequate for good performance evaluations. Author

N73-31828*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL STUDY OF SUPERSONIC COMBUSTION OF HYDROGEN IN A VITIATED AIRSTREAM
Marshall C. Burrows and Anatole P. Kurkov Washington Sep. 1973 25 p refs
(NASA-TM-X-2828; E-6319) Avail: NTIS HC $2.75 CSCL 21B

Detailed probe measurements of total temperature, pressure, and composition were taken in a two-dimensional test section 35.6 cm downstream of hydrogen injection. A high pressure gas generator supplied Mach 2.44 vitiated air or inert gas at elevated temperatures and at a static pressure equal to that of the hydrogen. Special water-cooled probes and sampling techniques were developed for the short test times required by heat-sink hardware. Independent methods of measuring stream total temperatures are compared. For the pure mixing case, the computed composition profile agreed well with the experimental profile. The analysis takes into account the wall boundary layer and the initial boundary layer in the main stream. Ignition of hydrogen, as determined from photographic exposures of the radiating gases, varied from 30 to 10 cm downstream from injection for a 45 K increase in local free-stream static temperature. Author

N73-31829*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
ICE PACK HEAT SINK SUBSYSTEM - PHASE 1, VOLUME 2
George J. Roebelen, Jr. Jun. 1973 84 p 2 Vol.
(Contract NAS2-7011)
(NASA-CR-114624-Vol-2; SVHSER-6223-Vol-2) Avail: NTIS HC $6.25 CSCL 20M

The design, development, and test of a functional laboratory model ice pack heat sink subsystem are discussed. Operating instructions to include mechanical and electrical schematics, maintenance instructions, and equipment specifications are presented. Author

N73-31830# Advisory Group for Aerospace Research and Development, Paris (France).
GAS SAMPLING AND ANALYSIS IN COMBUSTION PHENOMENA
G. Lengelle (ONERA, Paris) and C. Verdier (ONERA, Paris) Jul. 1973 185 p refs
(AGARD-AG-168; AGARDOGRAPH-168) Avail: NTIS HC $11.25

The application of gas analysis techniques to determine combustion efficiency in turbine engines and rocket engine combustion chambers is discussed. The fundamental data for combustion kinetics in a perfectly stirred reactor and in premixed laminar flames are reported. Various methods of gas analysis using gas phase chromatography, mass spectrometry, absorption of electromagnetic, absorption of electromagnetic radiations, and physicochemical methods of flow-through analysis are explained. Author

N73-31831# Joint Publications Research Service, Arlington, Va.
USSR HIGH TEMPERATURE INSTITUTE
7 Sep. 1973 236 p refs Transl. into ENGLISH of the books "Vazhneyshiye Rezultaty Nauchno-Issledovatelskikh Rabot 1972 Goda" Moscow, Nauka, 1973 85 p and "Issledovaniya na Ustanovke U-25 (1)" Moscow, Akad. Nauk SSSR, Inst. Vysokikh Temperatur, 1973 165 p
(JPRS-59983) Avail: NTIS HC $14.00

Results are described of research conducted at the High Temperature Institute of the U.S.S.R. Academy of Science and a general description is given of the U-25 pilot apparatus with a magnetohydrodynamic power generator. For individual titles, see N73-31832 through N73-31833.

N73-31832 Joint Publications Research Service, Arlington, Va.
MOST IMPORTANT RESULTS OF SCIENTIFIC RESEARCH IN 1972
In its USSR High Temp. Inst. (JPRS-59983) 7 Sep. 1973 p 1-102 refs Transl. into ENGLISH of the book "Vazhneyshiye Rezultaty Nauchno-Issledovatelskikh Rabot 1972 Goda" Moscow, Nauka, 1973 85 p (For availability see N73-31831 22-33)

Results are presented of Soviet high temperature research conducted during 1972. Scientific research covered four general areas: (1) studies of thermophysical and electrophysical properties of matter at high temperatures; (2) investigations of heat exchange, mass exchange, and physical gas dynamics processes; (3) development and investigation of new heat resistant construction materials; and (4) studies aimed at the development of systems for direct conversion of heat energy into electricity, especially with the aid of MHD generators and other new types of power generating systems. Author

N73-31833 Joint Publications Research Service, Arlington, Va.
RESEARCH ON THE U-25 APPARATUS **c25**
V. A. Kirillin, V. V. Kirillov, V. G. Kirillov, Yu. M. Momotov, I. L. Mostinskiy, A. V. Nedospasov, S. A. Pashkov, M. S. Pinkhasnk, S. I. Pishchikov, L. P. Poberezhskiy et al *In its* USSR High Temp. Inst. (JPRS-59983) 7 Sep. 1973 p 103-232 refs Transl. into ENGLISH of the book "Issledovaniya na Ustanovke U-25 (I)" Moscow, Akad. Nauk SSSR, 1973 165 p (For availability see N73-31831 22-33)

The U-25 pilot apparatus with an open cycle MHD generator operates the combustion products of natural gas with potassium carbonate additive as the ionizing additive. The choice of scales and setup or the pilot installation were based on the following considerations: (1) The pilot MHD apparatus should be designed on the base of the capabilities of modern technology, incorporating construction materials that have already been industrially adopted. (2) The parameters of the installation should be low enough to ensure the reliability required for long-term industrial operation of the installation. (3) The dimensions of the installations should be such that harmful side effects be small in comparison with the basic beneficial effect and that the installation be capable of industrial power generation. (4) Natural gas should be used as the fuel for the pilot installation, since the use of other forms of fuel in an MHD apparatus entails additional difficulties. The initial temperature of the combustion products in the MHD generator is set at 2600 C to ensure an acceptable level of conductivity. Preheating of air in the U-25 apparatus is limited to 1200 C with enrichment. Heat from the MHD generator is used in the steam power cycle. Author

N73-31834*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAT PIPE STABILITY. 1: A PRELIMINARY INVESTIGATION INTO THERMALLY ASSISTED CAVITATION
Jul. 1973 19 p refs
(NASA-TM-X-70458; X-764-73-224) Avail: NTIS HC $3.00 CSCL 20M

The notion is introduced of thermally assisted cavitation by localized fluctuations in capillary forces. Because cavitation in liquids can be closely approximated by an isothermal process,

only momentum and mass balances are used to introduce the notion for liquids under mechanical tension. Brief attention is given to developing a stability theory in terms of the stiffness and compliance coefficients for a working fluid. Interestingly, the particular thermodynamic approach taken can be used to suggest experiments relating working fluid performance to meniscus behavior. A correction to the liquid flow equation is suggested. Author

N73-31835*# Acurex Corp., Mountain View, Calif.
NONEQUILIBRIUM CHEMISTRY BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE Final Report
Henry Tong, Alfred C. Buckingham, and Howard L. Morse Jul. 1973 165 p refs
(Contract NAS9-9494; Aerotherm Proj. 6099)
(NASA-CR-134039; Aerotherm-73-67; Rept-73-67) Avail: NTIS HC $10.25 CSCL 20M

The development of an analytic procedure for the calculation of nonequilibrium boundary layer flows over surfaces of arbitrary catalycities is described. An existing equilibrium boundary layer integral matrix code was extended to include nonequilibrium chemistry while retaining all of the general boundary condition features built into the original code. For particular application to the pitch-plane of shuttle type vehicles, an approximate procedure was developed to estimate the nonequilibrium and nonisentropic state at the edge of the boundary layer. Author

N73-31836# Defence Standards Labs., Maribyrnong (Australia).
THE COMBUSTION OF ORGANIC POLYMERIC MATERIALS, EVALUATION OF FLAMMABILITY BY THE OXYGEN INDEX METHOD
J. R. Brown and P. Dunn Jun. 1973 25 p refs
(DSL-Rept-561) Avail: NTIS HC $3.25

The oxygen index method has been used to evaluate the relative flammabilities of a number of organic polymeric materials of interest to the Navy, including panelling materials, fire-retarded timbers, adhesives, fiber glass laminates, cellular polymers, cable insulating materials, textiles, cordage, and surface coatings. The method provides a measure of the minimum volume fraction of oxygen in a mixture of oxygen and nitrogen which is capable of sustaining candle-like combustion of a material. This value, termed the oxygen index, constitutes a convenient, reproducible numerical rating of the flammabilities of materials of interest. Author

N73-31837# Defence Standards Labs., Maribyrnong (Australia).
THE COMBUSTION OF ORGANIC POLYMERIC MATERIALS: SMOKE GENERATION
J. R. Brown and P. Dunn Jun. 1973 39 p refs
(DSL-Rept-560) Avail: NTIS HC $4.00

The smoke generated by a number of organic materials of interest to the Navy, including panelling materials, fire-retarded timbers, adhesives, fiber glass laminates, cellular polymers, cable insulating materials, textiles, and surface coatings was evaluated using a Rohm and Haas XP2 smoke density test chamber. Light attenuation by smoke was measured photometrically and results have been reported in terms of maximum smoke generation, maximum rate of smoke generation, the time period required to reach an arbitrary critical smoke level, and the time period to reach maximum smoke generation. Author

N73-31838# Aeronautical Research Labs., Melbourne (Australia).
THE CALCULATION OF FLAME TEMPERATURES AT CONSTANT PRESSURE AND CONSTANT VOLUME
L. W. Hillen Feb. 1973 24 p refs
(ARL/ME-Note-341) Avail: NTIS HC $3.25

Methods are described for caculating flame temperatures in systems under constant pressure or constant volume condition. Results for propane under a variety of precombustion conditions are presented. Author

N73-31839*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
ELECTROHYDRODYNAMIC HEAT PIPE RESEARCH
T. B. Jones and M. P. Perry Jul. 1973 49 p refs
(Grant NGR-06-002-127)
(NASA-CR-114646; RR-4) Avail: NTIS HC $4.50 CSCL 20M

Experimental and theoretical applications to electrohydrodynamic heat pipe (EHDHP) research are presented. Two problems in the research which are discussed are the prediction of the effective thermal conductance of an EHDHP with threaded grooves for fluid distribution to the evaporator of an EHDHP. Hydrodynamic equations are included along with a discussion of boundary conditions and burn-out conditions. A discussion of the theoretical and experimental results is presented. K.M.M.

N73-31840*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APOLLO 17 HEAT FLOW AND CONVECTION EXPERIMENTS: FINAL DATA ANALYSES RESULTS
T. C. Bannister, P. G. Grodzka, L. W. Spradley, S. V. Bourgeois, R. O. Hedden, and B. R. Facemire 16 Jul. 1973 164 p refs Prepared in cooperation with Lockheed Missiles and Space Co., Huntsville, Ala.
(Contract NAS8-25577)
(NASA-TM-X-64772) Avail: NTIS HC $10.25 CSCL 20M

A group of experiments called the Apollo 17 heat flow and convection (HFC) experiments was conducted, aboard the Apollo 17 spacecraft while in translunar coast on the way to the moon. These experiments together with the HFC experiments flown on Apollo 14 demonstrated and provided data on two types of low-g natural convection: cellular, surface tension-driven convection and convection in confined fluids caused by spacecraft and astronaut movements. Observed convection onset times show that surface tension-driven convection occurs at lower temperature gradients in low-g than in one-g environments. Data on heat flow in confined fluids show that spacecraft and astronaut movements can cause significant degrees of convection. Author

N73-31841*# Aerojet Liquid Rocket Co., Sacramento, Calif.
HYDROGEN FILM COOLING INVESTIGATION
D. C. Rousar and R. L. Ewen Aug. 1973 207 p refs
(Contract NAS3-15844)
(NASA-CR-121235) Avail: NTIS HC $12.50 CSCL 20M

Effects of flow turning, flow acceleration, and supersonic flow on film cooling were determined experimentally and correlated in terms of an entrainment film cooling model. Experiments were conducted using thin walled metal test sections, hot nitrogen mainstream gas, and ambient hydrogen or nitrogen as film coolants. The entrainment film cooling model relates film cooling effectiveness to the amount of mainstream gases entrained with the film coolant in a mixing layer. The experimental apparatus and the analytical model used are described in detail and correlations for the entrainment fraction and film coolant-to-wall heat transfer coefficient are presented. Author

N73-31842*# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
THE ENVIRONMENTAL HEAT FLUX ROUTINE, VERSION 4 (EHFR-4) AND MULTIPLE REFLECTIONS ROUTINE (MRR), VOLUME 1 Final Report
J. B. Dietz 24 Aug. 1973 204 p refs
(Contract NAS9-7644)
(NASA-CR-134031; T155-01-Vol-1) Avail: NTIS HC $12.25 CSCL 20M

The environmental heat flux routine version 4, (EHFR-4) is a generalized computer program which calculates the steady state and/or transient thermal environments experienced by a space system during lunar surface, deep space, or thermal vacuum chamber operation. The specific environments possible for EHFR analysis include: lunar plain, lunar crater, combined lunar plain and crater, lunar plain in the region of spacecraft surfaces, intervehicular, deep space in the region of spacecraft surfaces, and thermal vacuum chamber generation. The EHFR was used for Extra Vehicular Mobility Unit environment analysis of the Apollo 11-17 missions, EMU manned and unmanned thermal vacuum qualification testing, and EMU-LRV interface environmental analyses. Author

N73-31843# Bettis Atomic Power Lab., Pittsburgh, Pa.
APACHE: A THREE-DIMENSIONAL FINITE ELEMENT PROGRAM FOR STEADY-STATE OR TRANSIENT HEAT

CONDUCTION ANALYSIS
D. N. Hutula, B. E. Wiancko, and S. M. Zeiler Mar. 1973 111 p refs
(Contract AT(11-1)-Gen-14)
(WAPD-TM-1080) Avail: NTIS HC $7.25

APACHE (a program for analysis of conduction of heat) is a digital computer program for nonlinear steady-state or transient analysis of heat conduction in three-dimensional solids. The finite element method is used with eight-node tri-linear isoparametric elements. The program, written in FORTRAN 4 and COMPASS Assembly Language for the CDC-6600 and CDC-7600 computers, is designed for use with the MATUS (structural analysis) and MESH3D (mesh generator) finite element computer programs. Problems with up to about 4000 nodes can be solved on a 60-bit word length computer with a central memory size of 64K and an extended core size of 512K. (K = 1024).
Author (NSA)

N73-31844# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF LIQUID SODIUM
M. E. Durham Nov. 1972 24 p
(RD/B/M-2479; CFR/THWP/P-(72)28) Avail: AEC Depository Libraries HC $3.25

The thermodynamic and transport properties of saturated liquid sodium are presented in graphical form. Analytic expressions are also given from which the value of the particular property may be found as a function of temperature. S.I. units are used throughout. The properties of the sub-cooled liquid can be assumed equal to those of the saturated liquid at the same temperature, with negligible error. Conversion factors are given that enable the data to be expressed in Imperial and c.g.s. units.
Author (NSA)

N73-31845# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
THERMOCHEMICAL ANALYSIS OF HEXOGEN/METAL MIXTURES [THERMOCHEMISCHE UNTERSUCHUNGEN AN HEXOGEN/METALL - GEMISCHEN]
A. Pfeil 31 Dec. 1972 26 p refs In GERMAN
(ICT-12/72) Avail: NTIS HC $3.50

The reactivity of tungsten in a mixture of hexogen and aluminum was investigated in a bomb calorimeter. The optimal explosion heat of hexogen and aluminum, without tungsten, was determined. These results were compared with other mixtures, the aluminum content of which was gradually replaced by tungsten. The reaction conditions consisted of the highest charge density and pressure allowable in the calorimeter in order to approach real life conditions. At the same time, pressure measurements and explosion product analysis took place to obtain indications about the possible reaction mechanisms. ESRO

N73-31846# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A STUDY OF THE DECOMPOSITION PRODUCTS OF POLYURETHANE FOAM RELATED TO AIRCRAFT CABIN FLASH FIRES Final Report, Mar. 1971 - Jun. 1972
Maya Paabo and J. J. Comeford Jul. 1973 41 p refs
(Contract DOT-FA67NF-AP-21)
(AD-763327; FAA-NA-73-69; FAA-RD-73-46) Avail: NTIS CSCL 07/4

A laboratory model of a flash fire cell using a high voltage arc as an ignition source was assembled and tested. The cell is designed to pyrolyze the sample in air while measuring the time of onset of a flash fire and simultaneously allowing withdrawal of gas samples for analysis. Some of the low molecular weight products produced from the pyrolysis of flexible polyether type urethane foams were identified. The flash fire cell was used to compare the flash fire potential of polymers of potential interest to the aircraft industry. Studies of the role of smoke in flash fire produced in the pyrolysis of flexible urethanes were undertaken. Flash fires in the cell were recorded on 16 mm motion picture film.
Author (GRA)

N73-31847# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECTS OF A MAGNETIC FIELD ON BURNING RATE OF SOLID PROPELLANT
Webster M. Kendrick, Leland A. Watermeier, William P. Aungst, and Samuel P. Pfaff Jun. 1973 31 p refs
(DA Proj. 1T1-61102-A-33C)
(AD-763894; BRL-1650) Avail: NTIS CSCL 21/2

Preliminary experiments conducted by the Interior Ballistics Laboratory to determine if a magnetic field applied during low pressure combustion of solid propellant can alter the burning rate have shown positive results. Experiments were conducted with a field strength of 15000 gauss applied to composite propellants containing aluminum additive burning at atmospheric and sub-atmospheric pressures. Although results showed wide scatter of data, it appears that burning rate variations of plus or minus 10% could be obtained.
Author (GRA)

N73-31848# Army Foreign Science and Technology Center, Charlottesville, Va.
DEVELOPMENT AND INVESTIGATION OF HIGH TEMPERATURE COMBUSTOR TO BE USED FOR A SOLID FUEL MHD GENERATOR AND THERMODYNAMIC ANALYSIS OF COMBUSTION CONDITIONS
S. A. Tager 13 Mar. 1973 16 p refs Transl. into ENGLISH from the publ. "5th International Conference on MHD Analysis of Combustion Conditions" Munich, Apr. 1971 15 p
(AD-764153; FSTC-HT-23-2007-72) Avail: NTIS

The basic principles of the high-temperature combustion of natural solid fuel are formulated. Variants are optimized; the scheme of a vertical cyclone with lower gas discharge, hardened slag lining protection of walls, and side removal of slag was adopted. Complete preliminary mixing of dry coal dust with all the high-temperature heated air and uniformly distributed feed of a ready dust-air mixture along the entire cyclone perimeter were carried out. A revised method of calculating high-temperature regimes for the combustion of solid fuel is presented that takes into account the actual operating conditions of the combustion chamber. The maximum attainable temperatures in the combustion of natural fuel were estimated. The combustion chamber, methods and conditions of the experiments are described. (Modified author abstract) GRA

N73-31849# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECT OF METAL ADDITIVES ON COMBUSTION RATE IN PROTOTYPE COMBUSTION SYSTEMS
N. N. Bakhman, A. F. Belyaev, and Yu. A. Kondrashkov 1 Nov. 1972 9 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 6, no. 1, Mar. 1970 p 93-97
(AD-764155; FSTC-HT-23-1001-72) Avail: NTIS CSCL 21/2

Additive powders of Al, Mg, B, Zn, Ti, and W in test mixtures of Nh4ClO4 with bitumen and polymethylene-methacrylate, and of KClO4 with bitumen, showed that adding finely divided metals to compounds having a weak dependence of combustion rate on pressure strengthens this dependence, whereas if the dependence u (p) is strong for the original compound, additivies weaken this dependence. Experimental results agree well with the theoretical model, which allows for simultaneous occurrence of homogeneous reaction between products of gasification of oxidant and or organic fuel, and the heterogeneous reaction of combustion of metal particles.
Author (GRA)

N73-31850# Frankford Arsenal, Philadelphia, Pa.
TEMPERATURE DISTRIBUTION IN IMPACTED PLATES
Paul F. Gordon Mar. 1973 29 p refs
(AD-763152; FA-M73-61-1) Avail: NTIS CSCL 19/4

A simplified model is presented for the heat transfer and subsequent temperature distribution in a thin metal target being impacted by a cylindrical projectile. The mechanism for the temperature generated is based on the linear Fourier law or diffusion assumption. An example of the transient temperatures in an aluminum target impacted by a steel projectile is given. The calculated temperature profiles are not in agreement with practical experience. It is concluded, based on this example, that this model is not appropriate for impact problems. A more refined model is suggested.
Author (GRA)

N73-31851# Army Foreign Science and Technology Center, Charlottesville, Va.

EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER IN SLIT-LIKE CHANNELS
P. Kramarenko 8 May 1973 8 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 20, no. 4, 1971 p 706-710 (AD-762793; FSTC-HT-23-1994-72) Avail: NTIS CSCL 20/13

The method and results of an experimental study of heat transfer in narrow slit channels are presented. GRA

N73-31852# Bureau of Mines, Pittsburgh, Pa.
RADICAL SPECIES PROFILES FOR A METHANE-OXYGEN-ARGON FLAME Report of Investigations, 1972 - 1973
Charles P. Lazzara, Joan C. Biordi, and John F. Papp Jun. 1973 15 p refs
(PB-221885/7; BM-RI-7766) Avail: NTIS HC $3.00 CSCL 21B

Concentration profiles of low pressure, slightly lean CH4-O2- Ar flames have been measured in situ for the following unstable species: oxygen atom, hydrogen atom, hydroxyl radical, methyl radical, and formyl radical. (Modified author abstract) GRA

N73-31865* California Inst. of Tech., Pasadena. Daniel and Florence Guggenheim Jet Propulsion Center.
A NEW LOOK AT AP/COMPOSITE PROPELLANT COMBUSTION
R. N. Kumar *In* JPL JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 45-77 refs (For availability see N73-31858 22-34)
CSCL 21B

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-31853# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 APRIL - 30 JUNE 1973
30 Jun. 1973 112 p refs
(DME/NAE-1973(2)) Avail: NTIS $7.75

Research progress in sleep deprivation effects on accuracy and speed of response, airborne simulator feel system, and bed forms generated by wave action is presented. Experience with the NRC 10 ft x 20 ft V/STOL propulsion tunnel used for testing V/STOL engine models is also reviewed. For individual titles, see N73-31854 through N73-31857.

N73-31854 National Research Council of Canada, Ottawa (Ontario). Control System Lab.
SLEEP DEPRIVATION EFFECTS ON ACCURACY AND SPEED OF RESPONSE SELECTION AND EXECUTION c04
Leslie Buck *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 1-12 refs (For availability see N73-31853 22-34)

Sleeping subjects performed a subject-paced step-tracking task after zero, one and two nights without sleep. Their performance compared to performance when following a similar regime with normal sleep showed no change in accuracy but a progressive reduction in speed. Movement times increased with sleep loss and reaction times increased to an amount dependent on signal probability. Author

N73-31855 National Research Council of Canada, Ottawa (Ontario). Flight Research Lab.
A SHORT DESCRIPTION OF THE NAE AIRBORNE SIMULATOR FEEL SYSTEM c11
W. E. B. Roderick *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 13-20 (For availability see N73-31853 22-34)

The initial installation was a single channel (roll) wheel system using standard analogue techniques in conjunction with an electrohydraulic servoactuator. The two basic requirements were analytical accuaracy and subjective realism. The second requirement was the more difficult to attain. It was found that the overall system errors could be reduced to very low levels by standard servosystem techniques, but the subjective impression did not always correlate with analytical accuracy. The present three-axis center stick system was evolved. By revising the electronics for the modelling portion of each channel and careful attention to mechanical design details, both the analytic and subjective performance of the feel system appear to be excellent. Author

N73-31856 National Research Council of Canada, Ottawa (Ontario). Hydraulics Lab.
BED FORMS GENERATED BY WAVE ACTION c13
G. R. Mogridge *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 21-41 refs (For availability see N73-31853 22-34)

The bed forms resulting from the action of waves were investigated over a wide range of wave conditions, achieved by the use of a laboratory wave flume and an oscillating water tunnel. Dimensional analysis of the parameters necessary and sufficient to describe the properties of the bed forms, produced four dimensionless variables. Each variable was tested to determine its effect on the bed form properties of length, height, and steepness. The types of sediment used were bakelite, polystyrene, and sand. Design curves were produced to predict the length and height of the bed forms developed on a specified sediment bed for the fluid oscillation caused by any wave conditions. Author

N73-31857 National Research Council of Canada, Ottawa (Ontario). Gas Dynamics Lab.
EXPERIENCE WITH THE NRC 10 FT x 20 FT V/STOL PROPULSION TUNNEL, SOME PRACTICAL ASPECTS OF V/STOL ENGINE MODEL TESTING c11
R. A. Tyler and R. G. Williamson *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 34-59 refs (For availability see N73-31853 22-34)

This research facility, designed specifically for the investigation of problems relating to V/STOL engine systems, was first operated in December 1962. Representative experimental programs carried out in the tunnel since that time are used to illustrate general problem areas associated with the testing of high powered models. Author

N73-31858*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL QUARTERLY TECHNICAL REVIEW, VOLUME 3, NO. 2, JULY 1973
Jul. 1973 231 p refs
(Contract NAS7-100)
(NASA-CR-133863) Avail: NTIS HC $13.75 CSCL 05B

A compilation of articles dealing with propulsion systems, equipment, rocket propellants, and radiation safety for interplanetary spacecraft are given. For individual titles, see N73-31859 through N73-31866.

N73-31859* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEVELOPMENT AND DEMONSTRATION OF HYBRID PROGRAMMABLE ATTITUDE CONTROL ELECTRONICS c10
L. S. Smith and E. H. Kopf, Jr. *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 1-10 refs (For availability see N73-31858 22-34)
CSCL 09C

In the course of extended life attitude control system (ELACS) research sponsored by NASA a hybrid programable attitude control electronics (HYPACE) concept was developed and demonstrated. The wide variety of future planetary missions demanded a new control approach to accommodate the automatic fault tolerance and long the life requirements of such missions. HYPACE provides an adaptable, analog/digital design approach that permits preflight and in-flight accommodation of mission changes, component performance variations, and spacecraft changes, through

programing. This enabled broad multimission flexibility of application in a cost effective manner. Previously, flight control computers have not been not flown on planetary missions because of weight and power problems. These problems were resolved in the design of HYPACE. The HYPACE design, which was demonstrated in breadboard form on a single-axis gas-bearing spacecraft simulation, uses a single control channel to perform the attitude control functions sequentially, thus significantly reducing the number of component parts over hard-wired designs. Author

N73-31860* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INDUCED SHOCK PULSE TESTING BY TRANSIENT WAVEFORM CONTROL c11
B. K. Kim *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 11-22 refs (For availability see N73-31858 22-34)
CSCL 14B

A method of synthesizing an arbitrarily shaped transient time pulse on vibration exciters is described. The transient waveform control technique is based on recent developments in digital time series analysis, the real-time FFT processor. A brief description of the theory, error estimates and hardware/software implementation to the JPL Dynamic Environmental Testing Laboratory is presented. Author

N73-31861* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NASA/JPL DEEP SPACE NETWORK 64 METER DIAMETER ANTENNA DUAL FREQUENCY FEED SYSTEM c09
P. D. Potter *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 23-26 ref (For availability see N73-31858 22-34)
Copyright. CSCL 17B

To support the Mariner 1973 X-band experiment, it was necessary to implement a dual-frequency microwave feed system for the Cassegrainian-fed DSS 14 64-m antenna. This system must be capable of simultaneous low noise reception at S- and X-bands and high power transmission at S-band. The design and measured perfromance of the DSS 14 reflex feed system is described. Author

N73-31862* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SILICON VIDICON CAMERA FOR SLOW SCAN OPERATION c14
W. M. Potter *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 27-36 (For availability see N73-31858 22-34)
CSCL 14E

A silicon vidicon camera was designed, built, and tested to determine its potential for use aboard future Mariner spacecraft. Slow scan operation is made possible by cooling the vidicon to -40 C. Cooling is achieved by a simple thermal condition path between the vidicon and a radiator mounted on top of the camera head. The camera was successfully operated under simulated space flight conditions and has survived vibration designed to simulate the launch of a Mariner spacecraft. A description of the camera and its operation along with the results of the testing is presented. Author

N73-31863* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROBABILITIES FOR THE PEAK FLUX AND FLUENCE OF ENERGETIC SOLAR PROTONS INCIDENT ON INTERPLANETARY SPACECRAFT c29
N. Divine *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 37-44 refs (For availability see N73-31858 22-34)
CSCL 03B

Energetic protons injected into interplanetary space in solar particle events can interfere with spacecraft operations and experiments and can cause permanent degradation of some components. For future long term interplanetary and planetary missions, techniques were developed which use solar particle event data from 1956 through 1970 to predict the probability of exceeding any value of peak proton intensity or mission proton fluence. Dependences on proton energy (near 10 to 100 MeV), heliocentric distance, and phase of the solar cycle are included. The techniques are described and applied to the Mariner Jupiter/Saturn 1977 mission. Author

N73-31864* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF PROPULSION FOR HIGH ATMOSPHERIC PRESSURE OR DENSE ENVIRONMENTS c28
G. Varsi, L. H. Back, and W. L. Dowler *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 45-52 refs (For availability see N73-31858 22-34)
CSCL 21H

The development of a propulsion system that employs a detonating propellant is described, and the need for such a system and its use in certain planetary atmospheres are demonstrated. A theoretical formulation of the relevant gas-dynamic processes was developed, and a related series of experimental tests were pursued. Author

N73-31865* California Inst. of Tech., Pasadena. Daniel and Florence Guggenheim Jet Propulsion Center.
A NEW LOOK AT AP/COMPOSITE PROPELLANT COMBUSTION c33
R. N. Kumar *In* JPL JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 45-77 refs (For availability see N73-31858 22-34)
CSCL 21B

Some theoretical studies on the time-independent and oscillatory combustion of nonmetallized ammonium perchlorate (AP)/composite propellants are presented. A coherent and unified interpretation was made of the voluminous data available from experiments related to propellant combustion. Three fundamental hypotheses are introduced: the extent of propellant degradation at the vaporization step has to be specified through a scientific criterion; the condensed-phase degradation reaction of ammonium perchlorate to a vaporizable state is the overall rate-limiting step; gas-phase combustion rate is controlled by the mixing rate of fuel and oxidizer vapors. In the treatment of oscillatory combustion, the assumption of quasi-steady fluctuations in the gas phase is used to supplement these hypotheses. Author

N73-31866* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVED SPATIAL UNIFORMITY OF BEAM-PLANE INTERACTION BY MEANS OF INVERSE RASTERING c24
C. G. Miller *In its* JPL Quart. Tech. Rev., Vol. 3, No. 2 (NASA-CR-133863) Jul. 1973 p 78-90 refs (For availability see N73-31858 22-34)
CSCL 18H

An analysis is presented that shows the desirability and feasibility of conducting irradiations of large test objects by beams of penetrating radiation, by the method of moving the test object back and forth through the beam, rather than by sweeping the beam across the object. An extension of this method of inverse rastering allows the generation of composite beams with any desired intensity-vs-energy spectrum, obviating the need to determine equivalent damage factors for every energy in the spectrum. Author

N73-31867*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ACCOMPLISHMENTS IN SCIENCES: GODDARD SPACE FLIGHT CENTER, 1972
Washington 1973 223 p Proc. of a Symp., Greenbelt, Md., 7-8 Nov. 1972
(NASA-SP-331) Avail: NTIS HC $5.50 CSCL 05B

Space applications research is reported in the following areas: High energy and solar astronomy; optical and UV astronomy; Planetary, lunar, and cometary studies; earth observations; and earth physics. For individual titles, see N73-31868 through N73-31912.

N73-31868* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH ENERGY AND SOLAR ASTRONOMY, OVERVIEW c30

Frank B. McDonald *In its* Significant Accomplishments in Sci. 1973 p 7-8 refs (For availability see N73-31867 22-34)
CSCL 03A

A survey of our own galaxy and neighboring galaxies using X-rays, gamma rays, and cosmic rays is outlined. High energy astrophysic results suggest the presence of a new acceleration mechanism where the inflow of matter on collapsed objects seems to be one of the sources of complex time variations in binary systems. G.G.

N73-31869* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITRON ANNIHILATION RADIATION FROM NEUTRON STARS **c29**
Gerhard A. Borner *In its* Significant Accomplishments in Sci. 1973 p 9-11 (For availability see N73-31867 22-34)
CSCL 03B

Balloon observations of a low energy flux line at 2 x 0.001 photons cm/2 s/1 from the galactic center region around 470 keV are interpreted as the positron annihilation radiation that occurs on the surface of old neutron stars and is redshifted by their gravitational fields. An astrophysical model is formulated to explain the observed flux that provides for about 0.2 neutron stars per 3 x 10 to the 49th power cubic meters assuming that the disk thickness is about 1.5 x 10 to the 19th power meters. G.G.

N73-31870* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY OBSERVATIONS OF THE SUPERNOVA REMNANTS Cas A AND TYCHO **c30**
Axel Brisken *In its* Significant Accomplishments in Sci. 1973 p 12-15 (For availability see N73-31867 22-34)
CSCL 03A

A rocket-borne multilayer multianode proportional counter observation of Cas A and Tycho supernovae remnants shows no evidence for periodic emissions in the period range from 1 millisecond to 13 seconds. Comparison of inferred incident photon spectra and electromagnetic flux intensity as a function of energy rules out simple synchrotron or isothermal models for both Cas A and Tycho. It is concluded that there must still be a contemporary source of energy in the source region to connect the radio and X-ray emission from these remnants. G.G.

N73-31871* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC SECONDARY GAMMA RADIATION **c29**
David J. Thompson *In its* Significant Accomplishments in Sci. 1973 p 16-19 (For availability see N73-31867 22-34)
CSCL 03B

A theoretical model in the form of a three-dimensional Monte Carlo calculation is developed that starts with known cosmic ray flux at the top of the atmosphere and follows particles as they interact with the atmosphere for a schematic representation of how atmospheric secondary gamma rays are produced. The model predicts atmospheric secondary gamma radiation as a function of altitude, energy, and zenith angle. G.G.

N73-31872* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRIMARY AND SECONDARY NUCLEI IN HIGH-ENERGY COSMIC RAYS **c29**
Jonathan F. Ormes *In its* Significant Accomplishments in Sci. 1973 p 20-23 (For availability see N73-31867 22-34)
CSCL 03B

Charge and particle trajectory measurements during a balloon-borne experiment observing the composition of cosmic rays, are interpreted by plotting differential intensities of various nuclei of both primary and secondary origin above 3 GeV/nucleon. The large spectral difference between carbon plus oxygen and iron is confirmed in the difference between their secondary products. This large difference cannot be explained as being solely due to propagation effects and it is concluded that preferential acceleration of heavy nuclei due to a source effect is present. G.G.

N73-31873* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROGRESS IN THE MEASUREMENT OF HIGH-ENERGY GALACTIC COSMIC RAY ELECTRONS **c29**
Robert F. Silverberg *In its* Significant Accomplishments in Sci. 1973 p 24-28 (For availability see N73-31867 22-34)
CSCL 03B

Cosmic ray electron measurements by individual threshold detector elements show that about 30 percent of observed electron-like galactic cosmic showers are really proton initiated events. The cosmic electron spectrum at about 10 GeV exhibits a consistent dropoff in intensity leading to a best fit at a power law of spectral index -3.2; a break in the spectrum should occur above 10 GeV. G.G.

N73-31874* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FIRST INTEGRATED INTERPLANETARY ELECTRON SPECTRUM **c29**
Thomas L. Cline *In its* Significant Accomplishments in Sci. 1973 p 29-33 (For availability see N73-31867 22-34)
CSCL 03B

Observations of a quiet-time interplanetary electron component in the 20 keV to 2 MeV energy range are reported. The measurements fill in the gap between the highest-energy known solar wind and the lowest-energy previously observed electron populations, and connect for the first time the entire solar-quiet interplanetary electron spectrum over a dynamic range of nearly 10 to the 12th power in energy. Author

N73-31875* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODULATION OF LOW-ENERGY GALACTIC COSMIC RAYS OVER THE PRESENT SOLAR CYCLE **c29**
Michele A. VanHollebeke *In its* Significant Accomplishments in Sci. 1973 p 34-37 (For availability see N73-31867 22-34)
CSCL 03B

Explorer satellite observations of modulations in the cosmic ray spectrum during the entire period of the solar cycle show intensity variations in the proton and alpha modulated spectra. A positive correlation between plasma density and variation in cosmic ray intensity is found that breaks during the transition period when higher energy intensity is decreasing as the solar activity increases. It is suggested that the alpha particles lead the proton particles during transition periods and thus make the lag time shorter for high rigidity near the solar maximum and the solar minimum. G.G.

N73-31876* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF SOLAR COSMIC RAYS AT 2 AU **c29**
James H. Trainor *In its* Significant Accomplishments in Sci. 1973 p 38-44 (For availability see N73-31867 22-34)
CSCL 03B

Solid state low-energy telescopic observations on solar and galactic cosmic rays from 2 AU outward by satellites are evaluated. Plots of solar events leading to large injections of particles from the sun show that low energy slower protons arrive first by many hours before the higher energy protons, and that the higher energy particles are falling off more rapidly. G.G.

N73-31877* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIAL GRADIENTS OF GALACTIC COSMIC RAY PROTONS AND HELIUM NUCLEI **c29**
Bonnard J. Teegarden *In its* Significant Accomplishments in Sci. 1973 p 45-48 (For availability see N73-31867 22-34)
CSCL 03B

Variation of the cosmic ray intensity as a function away from the sun and its radial derivative is studied by plotting satellite cosmic ray measurements against sea level neutron monitor data. Results show that the solar modulation cavity extends well beyond 2 AU and that irregularities in the sun's magnetic field are carried outward radially by the solar wind, thus sweeping low energy cosmic rays out of the solar system and at the same time cooling cosmic rays reaching the earth. G.G.

N73-31878* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR FLARE PRODUCED PULSATIONS IN METER AND X-RAY WAVELENGTHS **c29**
Kenneth J. Frost *In its* Significant Accomplishments in Sci. 1973 p 49-53 refs (For availability see N73-31867 22-34)
CSCL 03B

The mechanism responsible for the modulation of synchrotron radiation in the meter wave range by a solar flare is examined. The proposed explanation is based on the interaction of a flare generated shock front with a magnetic flux tube extending out into the corona over the flare. As the shock wave propagates through the flux tube, Alfven waves are developing and travelling up the tube toward each other, thereby accelerating electrons and protons by the Fermi mechanism and thus filling the top of the flux tube with energetic electrons. Radial oscillations develop as the shock front becomes parallel to the magnetic field direction and the intensity of the synchrotron radiation is modulated by these oscillations. An OSO-5 experiment detected a hard X-ray burst associated with the flare that produced modulated radio emission and X-ray modulations that are attributed to density fluctuations in the X-ray bursts. G.G.

N73-31879* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPATIAL STRUCTURE OF A TWO-PHASE SOLAR FLARE OBSERVED IN THE EUV BY OSO-7 **c29**
Roger J. Thomas *In its* Significant Accomplishments in Sci. 1973 p 54-57 (For availability see N73-31867 22-34)
CSCL 03B

Soft X-ray and hydrogen alpha observations on the structure of a solar flare show the typical flare behavior - a rapid rise to maximum and a gradual exponential decay, with good time correlation between the soft X-rays and H alpha. The emission is identified by Fe XI ion, and the emitting region is contoured on EUV maps. G.G.

N73-31880* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GROUND-BASED FLARE STUDIES AT SACRAMENTO PEAK **c29**
Stephen P. Maran *In its* Significant Accomplishments in Sci. 1973 p 58-62 (For availability see N73-31867 22-34)
CSCL 03B

The structure of an isolated solar flare point observed by vacuum telescope and multichannel spectrophotometer is considered. The tiny bright spot in H alpha photos lasted less than 30 seconds and coincided with a Type-III solar burst; a soft X-ray burst peaked at the time of this event. The small scale structure of the flare point exhibited in miniature the characteristics of a true flare event. G.G.

N73-31881* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STUDY OF SOLAR FLARES DURING THE NEXT SUNSPOT MAXIMUM **c29**
John C. Brandt *In its* Significant Accomplishments in Sci. 1973 p 63-68 (For availability see N73-31867 22-34)
CSCL 03B

Scientific goals and the instrumentation package for the OSO-K/solar flare mission are reported. The problem of determining origin and energetics of solar flares is considered. G.G.

N73-31882* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL AND UV ASTRONOMY, OVERVIEW **c30**
Anne B. Underhill *In its* Significant Accomplishments in Sci. 1973 p 71-75 (For availability see N73-31867 22-34)
CSCL 03A

The study of stars and other astronomical objects by means of radiation emitted in the range of 1,000 to 10,000 A is considered. Spectrum classification, astrophysical observations, distribution in space and physical properties of celestial objects are used to develop a view of the formation and evolution of the universe. G.G.

N73-31883* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET OBSERVATIONS OF PECULIAR B AND A STARS FROM OAO-2 **c30**
David S. Leckrone *In its* Significant Accomplishments in Sci. 1973 p 76-78 (For availability see N73-31867 22-34)
CSCL 03A

Plotted photometric data in two far-ultraviolet bandpasses at 1550 and 1430 A for both normal and peculiar stars are compared for flux distribution. It is shown that the ultraviolet flux distribution of an A sub p or B sub p star is consistent with its spectral class and is notably inconsistent with its UBV colors. It is assumed that the helium line strength suppression mechanism is related to an abnormal atmospheric structure in the peculiar stars. G.G.

N73-31884* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UV PHOTOMETRY OF ECLIPSING VARIABLES **c30**
Stanley Sobieski *In its* Significant Accomplishments in Sci. 1973 p 79-81 (For availability see N73-31867 22-34)
CSCL 03A

UV photometric observations of the eclipsing variable CW Cephei by orbiting OAO-2 instrument package reveal the binary to be a system in an active stage of evolution, with evidence for stellar mass loss or mass exchange. G.G.

N73-31885* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FORMATION OF PLANETARY NEBULAE **c30**
Warren M. Sparks *In its* Significant Accomplishments in Sci. 1973 p 82-84 (For availability see N73-31867 22-34)
CSCL 03C

A hydrodynamic model of a star consisting of a helium shell and a hydrogen-rich shell overlying a hard core is proposed in order to find out what causes the ejection of stellar mass with low velocities that form planetary nebulae. Observations indicate that a planetary nebula is composed of hydrogen-rich material, while the remaining remnant of the star is of helium or heavier material. G.G.

N73-31886* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERSTELLAR MOLECULAR HYDROGEN OBSERVED IN THE ULTRAVIOLET SPECTRUM OF DELTA SCORPII **c30**
Andrew M. Smith *In its* Significant Accomplishments in Sci. 1973 p 85-87 refs (For availability see N73-31867 22-34)
CSCL 03A

The ultraviolet spectrogram of delta Scorpii is analyzed for its interstellar molecular hydrogen signatures. Plots of the measured relative flux as a function of wavelength show the positions of the hydrogen lines in the Lyman and Werner bands. In general, each observed band is composed of transitions arising from the lowest rotational level and the first excited rotational level of the ground state, and of a single transition arising from the J = 1 level of the ground state only. Column densities of H2 molecules as well as cloud temperature are deduced. G.G.

N73-31887* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW-INTENSITY OPTICAL EMISSIONS FROM THE INTERSTELLAR MEDIUM **c29**
Ronald J. Reynolds *In its* Significant Accomplishments in Sci. 1973 p 88-91 (For availability see N73-31867 22-34)
CSCL 03B

Spectrometric scans of faint optical emissions from interstellar gas are reported. Systematic variations along the galactic plane in both the intensity and radial velocity of the galactic H alpha suggest that the diffuse emission is strongly associated with three nearby galactic spiral arms. G.G.

N73-31888* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SULFUR DOUBLET IN GALACTIC H-II REGIONS **c30**
Curtic W. McCracken *In its* Significant Accomplishments in Sci. 1973 p 92-95 (For availability see N73-31867 22-34)

CSCL 03C

Spectrographic scans for sulfur doublet intensity in the Orion nebula show that electron density decreases from about 15,000 down to about 1500 electrons per cubic centimeter within a few minutes of arc in both directions from the maximum. There appears to be small-scale structure in the electron density, with variations by a factor of two very common. Satisfactory agreement is obtained for electron density values derived from the oxygen doublet as well as from the sulfur doublet. G.G.

N73-31889* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERSTELLAR POLARIZATION IN THE ULTRAVIOLET **c30**
Theodore P. Stecher *In its* Significant Accomplishments in Sci. 1973 p 96-99 (For availability see N73-31867 22-34)
CSCL 03B

Ultraviolet interstellar polarization measurements in the direction of Zed Ophiuchi by rocket-borne scanning spectrophotometer are reported. The spectrophotometer was calibrated by a beam of polarized light. Plotted percent polarization against inverse wavelength in microns shows that polarization is running around 1.5 percent for this star, which is consistent with the visual observation. G.G.

N73-31890* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 100-MICRON OBSERVATIONS OF GALACTIC AND EXTRAGALACTIC SOUTHERN HEMISPHERE OBJECTS **c30**
William F. Hoffmann *In its* Significant Accomplishments in Sci. 1973 p 100-103 (For availability see N73-31867 22-34)
CSCL 03A

Far-infrared observations of the interstellar medium are reported by a balloon-borne telescope. With the 30-centimeter (12-in.) telescope operating at a wavelength of 100 microns, approximately forty new sources were observed in the galactic plane and in the large Magellanic Cloud. Patterns and some degree of understanding are beginning to emerge from the observations of objects in the far infrared. Author

N73-31891* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLANETARY, LUNAR, AND COMETARY STUDIES, OVERVIEW **c30**
Norman F. Ness *In its* Significant Accomplishments in Sci. 1973 p 107-112 (For availability see N73-31867 22-34)
CSCL 03C

Recent lunar and planetary oriented satellite missions are reviewed as are in situ measurements of magnetic fields, plasmas, and energetic particles in the earth's environment and in the sun's environment in heliocentric space. The detection of a planetary magnetic field on Mars is reported. G.G.

N73-31892* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARS: ITS ATMOSPHERE AND SURFACE **c30**
Rudolph A. Hanel *In its* Significant Accomplishments in Sci. 1973 p 113-122 (For availability see N73-31867 22-34)
CSCL 03B

Spectral experiments on Mars Orbiter show that solar energy is absorbed by the planet and its atmosphere and eventually re-emitted in the infrared as thermal emission. The majority of the radiances at the north polar Mars area follows very closely the radiance from a black body of about 145 degrees kelvin, which indicates a frozen CO2 surface; the south polar region radiance indicates a temperature inversion in the atmosphere, and the emission of atmospheric dust as well as emissions from frozen CO2. G.G.

N73-31893* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RETURNED LUNAR SAMPLE ANALYSIS **c30**
John A. Philpotts *In its* Significant Accomplishments in Sci. 1973 p 123-126 (For availability see N73-31867 22-34)
CSCL 03B

Studies on returned lunar samples are reported that emphasize the origin of the various lunar rocks. A heterogeneous accretion model and an igneous differention model are formulated and considered for the following three types of rocks: the iron rich basalts filling the mare basins; the KREEP basalts in Mare Imbrium and Oceanus Procellarum; and the anorthositic suite of the highlands. G.G.

N73-31894* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO ORBITAL GEOCHEMISTRY: X-RAYS **c29**
Isidore Adler *In its* Significant Accomplishments in Sci. 1973 p 127-131 (For availability see N73-31867 22-34)
CSCL 03B

Aluminum/silicon and magnesium/silicon concentration measurements along Apollo-15 and -16 lunar groundtracks by X-rays show that the highlands are very rich in aluminum, and that mare basalts cover large areas. G.G.

N73-31895* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO ORBITAL GEOCHEMISTRY: GAMMA RAYS **c29**
Jacob I. Trombka *In its* Significant Accomplishments in Sci. 1973 p 132-135 (For availability see N73-31867 22-34)
CSCL 03B

Lunar gamma ray spectra obtained during Apollo-15 and -16 flights show a natural radioactivity due to potassium, thorium, and uranium as well as a cosmic ray induced activity in the lunar surface due to high neutron interactions produced by (p,n) reaction in the lunar surface. The radioactivity is at a low in the highlands on the backside of the moon; most of the radioactivity is confined to the Oceanus Procellarum/Mare Imbrium region and to the Van de Graff area on the lunar backside. G.G.

N73-31896* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHEMICAL EVOLUTION OF COSMIC CLOUDS **c30**
Bertram D. Down *In its* Significant Accomplishments in Sci. 1973 p 136-141 (For availability see N73-31867 22-34)
CSCL 03C

Reaction rate characteristics of interstellar matter were studied by the reaction of hydrogen cyanide and molecular hydrogen at about 1000 K at an HCN to H2 ratio of 1 to 100 to simulate the large excess of cosmic hydrogen. It was found that HCN decays with a half life of about 20 hours and that a large surface increases the reaction rate as a function of temperature. Reaction rates may be considerable increased by energetic processes that produce free radicals and ions. G.G.

N73-31897* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMET ENCKE: METEOR METALLIC ION IDENTIFICATION BY MASS SPECTROMETER **c30**
Richard A. Goldberg and Arthur C. Aikin *In its* Significant Accomplishments in Sci. 1973 p 142-147 refs (For availability see N73-31867 22-34)
CSCL 03B

Positive metallic ions have been measured in the earth's atmosphere between 85 and 120 km, during the period of the beta Taurids meteor shower, which is associated with Comet Encke. The ions originate during and following ablation of extraterrestrial debris by the earth's atmosphere. The enhancement of metal ion density during meteor showers is primary evidence for their extraterrestrial origin. The present results were obtained from a rocket-borne ion mass spectrometer. Author

N73-31898* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMETARY SPECTRAL ISOPHOTES **c30**
William M. Jackson *In its* Significant Accomplishments in Sci. 1973 p 148-152 (For availability see N73-31867 22-34)
CSCL 03B

Observations of two recent bright comets, comet Bennet and comet Tago-Sato-Kosaka by a 91 centimeter telescope are reported. Results of monochromatic isophotes of the comets comas within 10,000 to 100,000 kilometers of their nuclei provide a spatial distribution of radicals, ions, and dust. G.G.

N73-31899* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSIONS TO COMETS **c30**
Robert W. Farquhar *In its* Significant Accomplishments in Sci. 1973 p 153-157 (For availability see N73-31867 22-34)
CSCL 22A

Missions to comets are outlined that form the basis for a new program to send a space probe to a comet. Simple flythroughs of the comet head will provide information about the composition of the ionized and neutral particles that make up the cometary atmosphere and on effects of solar-wind interaction with the comet. Projected are missions to the comets Grigg-Skjellerup, Encke, and Halley. G.G.

N73-31900* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATIONS, OVERVIEW **c13**
William Nordberg *In its* Significant Accomplishments in Sci. 1973 p 161-177 (For availability see N73-31867 22-34)
CSCL 08E

An overview is given of research and development activities at the Laboratory for Meteorology and Earth Sciences. Highlights of satellite techniques in earth observation missions and projects are outlined, as are remote sensing methods by aircraft overflights; most noteworthy among these is the development of multispectral scanners that monitor both the reflected infrared solar radiation and the emitted terrestrial radiation. The application of observations to the survey of environmental conditions and resource management is emphasized. G.G.

N73-31901* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MAPPING WITH ERTS-1 **c13**
James R. Greaves *In its* Significant Accomplishments in Sci. 1973 p 178-181 (For availability see N73-31867 22-34)
CSCL 08B

The applicability of multispectral ERTS-1 imagery to polar ice detection, local current effects, map corrections, relative lake depth measurements, and estimates of ice breakup is discussed. G.G.

N73-31902* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF SEA ICE MOTION **c13**
Albert Rango *In its* Significant Accomplishments in Sci. 1973 p 182-186 ref (For availability see N73-31867 22-34)
CSCL 08L

Remote sensing by ERTS-1 provides overlapping coverage on sequential days of dynamic changes in Arctic Sea ice and allows for route planning of shipping in the polar region. G.G.

N73-31903* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PASSIVE MICROWAVE IMAGES OF LAKE ICE **c14**
Per Gloersen *In its* Significant Accomplishments in Sci. 1973 p 187-189 (For availability see N73-31867 22-34)
CSCL 14E

Photographic data and microwave emission images from the Great Lake ice formation are compared for their applicability to commercial shipping interests. A synoptic view of the microwave radiation from the lake area ice shows a large variation in brightness temperature. The snow ice appears to have the highest microwave brightness temperatures, whereas the thick clear ice shows up some 30 degrees kelvin colder, and the thin clear ice is colder still with a 1.55 cm radiation. G.G.

N73-31904* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEANIC TURBIDITY AND CHLOROPHYLL AS INFERRED FROM ERTS-1 OBSERVATIONS **c13**
Robert J. Curran *In its* Significant Accomplishments in Sci. 1973 p 190-192 (For availability see N73-31867 22-34)
CSCL 08J

Spectral signatures of phytoplankton and other obscuring effects are considered in order to determine how to best use satellite data. The results of this study were then used to analyze the spectral data obtained from the ERTS-1 multispectral scanner (MSS). The analyzed satellite data were finally compared with surface ship measurements of chlorophyll concentration. It was found that the effects of water turbidity on the multispectral imagery can be discriminated by rationing the two shortest wavelength channels so that the effect of phytoplankton is enhanced. Author

N73-31905* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF THE ATMOSPHERE ON ERTS OBSERVATIONS **c13**
Robert S. Fraser *In its* Significant Accomplishments in Sci. 1973 p 193-195 (For availability see N73-31867 22-34)
CSCL 04A

Atmospheric radiation models and methods of computing radiation effects are reported that are important both in the meteorological and Earth Resources Satellite programs. Results of using them to compute the atmospheric effects on just the ERTS observations are presented. Author

N73-31906* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE OBSERVATIONS DURING THE RAPID INTENSIFICATION OF HURRICANE CAMILLE **c13**
William E. Shenk *In its* Significant Accomplishments in Sci. 1973 p 196-200 (For availability see N73-31867 22-34)
CSCL 04B

Medium resolution infrared radiometer observations at the 6.7 micrometer and the 11 micrometer regions by satellite during the maximum intensification phase of hurricane Camille show increasing black body temperatures near the center. This is attributed to increased upward vertical motion in the interior of the cyclone, which is an indication of rapid intensification. G.G.

N73-31907* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLOUD EMISSIVITY **c30**
Robert J. Curran *In its* Significant Accomplishments in Sci. 1973 p 201-204 (For availability see N73-31867 22-34)
CSCL 04A

Infrared interferometric spectra obtained by Nimbus-4 instrumentation are analyzed for the spectral properties of cloud brightness temperatures as a function of wave number. It is shown that cloud-top altitude determination can be corrected for emissions from lower levels in the cloud if an estimate can be made of the particle density. Brightness temperature in the 700 to 950 wave number region can be used to estimate cloud number density. G.G.

N73-31908* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIDES IN THE UPPER ATMOSPHERE: A CONTROVERSY RESOLVED? **c13**
John S. Theon *In its* Significant Accomplishments in Sci. 1973 p 205-208 (For availability see N73-31867 22-34)
CSCL 04A

Diurnal temperature variations in the upper atmosphere are caused by heating resulting from the absorption of solar energy by ozone near the stratopause and by water vapor in the troposphere. Theoretical temperature variations given as a function of time and height show a discrepancy for the maximum temperature variation. A comprehensive set of acoustic grande soundings establish phase changes with altitude in agreement with the theory although times of maximum and minimum are not aligned at all altitudes. G.G.

N73-31909* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH PHYSICS, OVERVIEW **c13**
Friedrich O. VonBun *In its* Significant Accomplishments in Sci. 1973 p 211 (For availability see N73-31867 22-34)
CSCL 08E

Satellite applications in earth and ocean dynamic studies are considered for: earthquake hazard assessment and alleviation; prediction of general ocean circulation, surface currents, and heat transport; monitoring of transient phenomena of the ocean surface, such as sea state and wave conditions, wind-surface interactions and storm searches; and refinement of the global geoid, the gravity and magnetic fields of the earth. G.G.

N73-31910* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DETAILED GRAVIMETRIC GEOID OF NORTH AMERICA, THE NORTH ATLANTIC, EURASIA, AND AUSTRALIA **c13**
James G. Marsh *In its* Significant Accomplishments in Sci. 1973 p 212-215 (For availability see N73-31867 22-34) CSCL 08N

A computer program was developed for the calculation of a goid based upon a combination of satellite and surface gravity data. A detailed gravimetric geoid of North America, the North Atlantic, Eurasia, and Australia was derived by using this program. G.G.

N73-31911* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MOTION **c13**
Ronald Kolenkiewicz *In its* Significant Accomplishments in Sci. 1973 p 216-219 (For availability see N73-31867 22-34) CSCL 08E

Tracking of the Beacon Explorer-C satellite by a precision laser system was used to measure the polar motion and solid earth tide. The tidal perturbation of satellite latitude is plotted as variation in maximum latitude in seconds of arc on earth's surface as a function of the date, and polar motion is shown by plotting the variation in latitude of the laser in seconds of arc along the earth's surface as a function of date G.G.

N73-31912* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ORIGIN OF INTERMEDIATE AND DEEP FOCUS EARTHQUAKES **c13**
Han-Shou Liu *In its* Significant Accomplishments in Sci. 1973 p 220-223 (For availability see N73-31867 22-34) CSCL 08E

An elastic plate model is used to describe the origin of intermediate and deep earthquakes. It is shown that the earth is covered by about eight tectonic plates that have relative motions; along plate boundary lines, one plate thrusting under the other, causes deflection and buckling of the elastic plate structure in regions of maximum curvature that may trigger earthquakes. G.G.

N73-31913*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DOMESTIC WASH-WATER RECLAMATION USING AN AEROSPACE-DEVELOPED WATER RECOVERY SUB-SYSTEM
John B. Hall, Jr. Washington Sep. 1973 26 p refs (NASA-TM-X-2896; L-9163) Avail: NTIS HC $3.00 CSCL 06I

A prototype aerospace distillation water recovery subsystem was tested to determine its capability to recover potable water from domestic wash water. A total of 0.0994 cu m (26.25 gallons) of domestic wash water was processed over a 7-day period at an average process rate of 0.0146 cu m per day (3.85 gallons per day). The subsystem produced water that met all United States Public Health Standards for drinking water with the exception of two standards which could not be analyzed at the required sensitivity levels. Average energy consumption for this evaluation to maintain both the recovery process and microbial control in the recovered water was approximately 3366 kilowatt-hours per cubic meter (12.74 kilowatt-hours per gallon) of water recovered. This condition represents a worst case energy consumption since no attempt was made to recover heat energy in the subsystem. An ultraviolet radiation cell installed in the effluent line of the subsystem was effective in controlling coliform micro-organisms within acceptable levels for drinking water. The subsystem recovered virtually 100 percent of the available water in the waste-water process. In addition, the subsystem removed 99.6 percent and 98.3 percent of the surfactants and phosphate, respectively, from the wash water. Author

N73-31914# Committee on Aeronautical and Space Sciences (U. S. Senate).
SKYLAB, PART 2 Report of Skylab 1 Investigation Board
Washington GPO 1973 46 p Hearing before Comm. on Aeron. and Space Sci., 93d Congr., 1st Sess., 30 Jul. 1973 Avail: Comm. on Aeron. and Space Sci.

A Congressional hearing concerning the cause of the malfunctions on the Skylab space vehicle was conducted. Various witnesses from NASA provided testimony on the evidence obtained from examination of the space station. Diagrams and photographs are included to clarify the written report. Author

N73-31915# National Aerospace Lab., Amsterdam (Netherlands).
THE FUTURE OF SHORT-HAUL AIR TRANSPORT WITHIN WESTERN EUROPE
Jun. 1973 69 p refs
(SP-73-001) Avail: NTIS HC $5.50

The potential growth of air transport in Western Europe is assessed in terms of the serious problems which may be associated with conventional takeoff anp landing characteristics of existing aircraft. The technologies and prospects for applications are discussed, and it is concluded that short-haul jet aircraft with reduced takeoff and landing distances offers the best compromise for relieving the noise and congestion problems and the economic penalties involved. Several recommendations are given, primarily related to alleviating the problems of the present air traffic system, and the introduction of new aircraft categories. Author

N73-31916# Committee on Science and Astronautics (U. S. House).
GAO REPORT ON ANALYSIS OF COST OF SPACE SHUTTLE PROGRAM
GPO Washington 1973 119 p refs Hearings, with Committee's summary and conclusions, before Comm. on Sci. and Astron., 93d Congr., 1st Sess., No. 5, 26 Jun. 1973
Avail: Subcomm. on Manned Space Flight

A Congressional hearing on the cost of the space shuttle program is presented. The findings of the Government Accounting Office are compared with the projected NASA programs to determine areas of agreement and disagreement. The information is presented in the form of testimony by knowledgeable witnesses. Statements of the witnesses are substantiated by tabulated data and bar graphs. The appendix contains a chapter by chapter refutation by NASA of the Government Accounting Office claims where discrepancies exist. Author

N73-31917# Committee on Science and Astronautics (U. S. House).
RESEARCH AND DEVELOPMENT COLLABORATION WITH THE USSR AND JAPAN
Richard T. Hanna and Robert A. Roe Washington GPO Sep. 1973 34 p Report presented to the Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 7 Sep. 1973
Avail: Subcomm. on Intern. Cooperation in Sci. and Space

A chronological summary is presented of the highlights of meetings and discussions which took place in Moscow and Tokyo between government officials concerning cooperative science and technology. Representatives of the United States aerospace industry were invited by the U.S.S.R. State Committee for Science and Technology to co-sponsor an Aeronautical Technology Symposium and Display. The U.S. Subcommittee on International Cooperation in Science and Space met with several officials of the Soviet government who have responsibilities for implementation of U.S. - U.S.S.R. Cooperative Agreements dealing with science and technology. Later, the Subcommittee met with officials of the Japanese government in Tokyo to discuss similar matters of mutual interest between the two nations. K.M.M.

N73-31918*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECORDING AND CATALOGING HAZARDS INFORMATION
Richard J. Stein 14 Sep. 1973 34 p refs
(NASA-TM-X-64782) Avail: NTIS HC $3.75 CSCL 05A

Investigating and reporting of accidents is basically a data collection process whose purpose is to discern causation factors of accidents. These factors, once known, lead, in turn, to either the establishment of boundaries or controls aimed at mitigating accident effects or eliminating accidents altogether. A procedure is proposed that suggests a discipline approach to hazard identification based on energy interrelationships together with

an integrated control technique which takes the form of checklists. Author

N73-31919# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1974. SPACE SHUTTLE AND ALTERNATE PROGRAMS. GAO ANALYSIS OF COST ESTIMATES
Washington GPO 1973 32 p refs Hearing on H.R. 8825 before Comm. on Appropriations, 93d Congr., 1st Sess., 12 Jun. 1973
Avail: Subcomm. of the Comm. on Appropriations

The GAO analysis of the cost estimates for the space shuttle is presented. Topics discussed include: cost estimates as basis for decision making, NASA cost estimates, economic justification for shuttle, payload costs, mission models, and cost overruns. F.O.S.

N73-31920*# Michigan Univ., Ann Arbor. Engineering Psychology Lab.
RESEARCH ON PROBABILISTIC INFORMATION PROCESSING Final Report
Ward Edwards Jul. 1973 43 p refs
(Grant NGL-23-005-171)
(NASA-CR-133918; Rept-08901-F) Avail: NTIS HC$4.25 CSCL 05B

The work accomplished on probabilistic information processing (PIP) is reported. The research proposals and decision analysis are discussed along with the results of research on MSC setting, multiattribute utilities, and Bayesian research. Abstracts of reports concerning the PIP research are included. F.O.S.

N73-31921# Army War Coll., Carlisle Barracks, Pa.
THE US AEROSPACE/DEFENSE INDUSTRY: A CURRENT ANALYSIS Individual Research Report
Anthony Carroll 2 Apr. 1973 36 p refs
(AD-763242) Avail: NTIS CSCL 05/3

Contents: The aerospace industry and the national economy; Competition increasing in the international market; Research and development in the aerospace industry; What are defense industry profits; Detailed analysis of the Lockheed Aircraft Corporation; GRA

N73-31922# Army Electronics Command, Fort Monmouth, N.J.
MASS MEASUREMENT TECHNIQUES TO DETECT AND IDENTIFY TARGETS Technical Progress Report, Oct. 1972 - Feb. 1973
Stephen F. Rurak Jul. 1973 36 p refs
(DA Proj. 1S6-62703-AJ-6201)
(AD-763889; ECOM-4136) Avail: NTIS CSCL 15/7

The research investigates the feasibility of using gravity measuring techniques as unattended sensors for the detection and classification of military targets. Currently available techniques for detecting mass are described together with the supporting mathematics. These techniques, as currently implemented in hardware, are compared to each other as to their detection sensitivity, and their growth potential. A table was developed which shows the sensitivities required to detect various sized targets at different ranges. The sensitivities required for a remotely monitored, unattended, hand emplaced, sensor are not attainable with equipment today; however, continuing development by various organizations holds promise that they will be attained in the near future. Author (GRA)

N73-31923# Naval Research Lab., Washington, D.C.
NRL PROGRESS REPORT, MARCH 1973
Mar. 1973 82 p
(PB-220703/3) Avail: NTIS HC $3.00 Also available on subscription $22.50/year domestic, $28.25/year foreign CSCL 05B

The document contains short articles in the fields of Acoustics, Chemistry, Communications Sciences, Electronics, Mathematics, Metallurgy, Optics, Radar, Shock and Vibration, and Solid state physics. One larger article is included, titled: Structural and Electrical Properties of Chalcogenide Glasses. GRA

N73-31924# Naval Research Lab., Washington, D.C.
NRL PROGRESS REPORT, APRIL 1973
Apr. 1973 85 p
(PB-221982/2) Avail: NTIS HC $3.00 Also available on subscription $22.50/year domestic, $28.25/year foreign CSCL 05B

The report discusses nuclear sciences and technology and neutron radiotherapy at NRL. In addition, brief articles are included in other fields of acoustics, chemistry, electronics, metallurgy, ocean sciences, ocean technology, radar, and structural dynamics. GRA

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